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Cross Florida Barge Canal Restudy Report Summary

Department of the Army Jacksonville District Corp of Engineers

THE CROSS FLORIDA BARGE CANAL

RESTUDY REPORT

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DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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CROSS FLORIDA BARGE CANAL RESTUDY REPORT

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SUMMARY

I. INTRODUCTION AND PROJECT HISTORY

A. STUDY OBJECTIVES. The objective of this study was to prepare a Restudy Report including an environmental assessment and analysis, engineering and cost studies, and updated economic studies on various alternatives for the Cross Florida Barge Canal Project. Detailed engineering, economics and environmental results are presented in separate documents and summarized herein. An environmental impact statement was prepared to accompany the Restudy Report. The basic framework for the studies was regional in scope and included baseline conditions as well as future conditions expected with and without the alternatives studied. Study area delineation was based upon the economic, social, and environmental systems involved. The overall Restudy Report addresses all major issues that have surfaced during the history of the project. These issues are discussed in the Engineering and Economics Reports and in the Environmental Impact Statement (EIS) and the Environmental Report and are summarized herein.

B. Authorization. The Cross Florida Barge Canal Project was authorized by Public Law 675, 77th Congress, dated 23 July 1942. The project would provide a barge waterway route between the St. Johns River at Palatka and the Gulf of Mexico at Yankeetown, a distance of about 110 miles (see figure 1). The project would include three dams, five locks, and a channel 12 feet deep and 150 feet wide.

C. Completed work. Construction of the project was started in February 1964 and terminated by the President in January 1971, after about 25 miles of channel, three of the five locks, the three dams and four bridges were completed (see figure 1 and 1A). A typical lock is shown on figure 3. The President directed that work in progress be terminated in an orderly manner to leave affected areas in a safe condition. Approximately $70 million have been invested in completed works and lands for the project.

D. Congressional and judicial impetus for restudy.

1. The appropriation of funds and the requirements for the Corps of Engineers to undertake the restudy result from congressional action contained in Public Law 92-405. An excerpt from that law (HR No. 92-1151, page 23, dated 19 June 1972) follows:

"The Committee has recommended in the bill $150,000 to initiate a detailed and complete environmental impact study of the project. The study should give consideration to all environmental and economic factors including those involved in the alternatives of completing or modifying the route and design. In addition, the study should include an evaluation of all environmental and other factors requisite to a determination of appropriate action to be taken in the management of completed portions of the project. Such a study, including the preparation of an environmental impact statement as required by Section 102 of the National Environmental Policy Act, has never been provided for the project, and the Committee believes that it is essential that such information be available before final determinations can be made concerning follow-on actions that are warranted in connection with the project.***"

2. Litigation had been in progress since enactment of the above referenced law and no funds had been allotted for the study. On 31 January 1974, Judge Harvey M. Johnsen, Senior Circuit Judge of the Eighth Circuit, sitting by designation, United States District Court, ruled in part that appropriate studies and reports should be prepared and he ordered that impounded funds should be released for that purpose. An excerpt from the Judge's ruling follows:

"*** The Director of the Office of Management and Budget is hereby directed to release and make available the $150,000 funds appropriated by Congress for use by the Corps of Engineers to prepare or have prepared for it a detailed and complete environmental impact study of the project with the inclusion therein of all environmental and other factors requisite to a determination of appropriate action to be taken in the management of completed portions of the project."

"A period of six months from the entry of this Judgment is hereby granted for having such EIS task completed and the EIS filed herein, except as some necessary extension thereof may be granted for good cause shown..."

"...The environmental impacts of this project are controversial and opposition has been indicated by organized groups including the Florida Defenders of the Environment, Environmental Defense Fund, and other similar organizations.

E. Interagency Coordinating Group (ICG). The Corps was the agency responsible for the overall conduct of the restudy effort. They were assisted by an Interagency Coordinating Group formed at the field level by the Jacksonville District Engineer. This field-level group, comprised of interested Federal and State agencies, was established primarily to attempt to minimize agency differences and determine the

scope of the Restudy Report and EIS. Other purposes include: (1) assisting in preparation of the plan of study, (2) developed the various alternative study plans which ranged from the project as authorized to restoring the area to the pre-project condition, (3) aiding in the development of criteria for work to be done under contract, (4) serving in an advisory capacity in the listing of potential consultants, and (5) providing input data to and participating in periodic meetings and workshops during the study effort. Participating in the ICG, in addition to the Corps of Engineers, were: (a) Department of Interior, including Fish and Wildlife Service, Bureau of Outdoor Recreation, and U. S. Geological Survey; (b) Environmental Protection Agency; (c) Department of Agriculture, Forest Service; and (d) State agencies, including Department of Natural Resources, Florida Game and Fresh Water Fish Commission, Canal Authority, and Department of Administration. In addition to having representation on the ICG, the agencies provided assistance with respect to their areas of interest. The Corps of Engineers entered into intergovernmental agreements with several of these agencies to provide data and studies in their respective areas of expertise.

F. Washington Policy Group (WPG). A Washington policy group composed of representatives of the concerned agencies was established by the Department of the Army to facilitate communication and resolution of policy problems. The Washington Policy Group was established to resolve substantive issues that were referred in writing to the Jacksonville District Engineer by ICG members and not resolved by the District Engineer. Participating in the group are the Under Secretary of the Department of the Interior; the Deputy Administrator of the Environmental Protection Agency; the Chairman of the Council on Environmental Quality; the Associate Director for Natural Resources, Energy and Science, Office of Management and Budget; and the Office of the Secretary of the Army.

G. Plan of Study (POS). A plan of study was prepared to set out clearly the study objectives, establish procedures for study management and participation, address issues and determine alternative actions to be analyzed, set guidelines for the required environmental, engineering, and economic studies and to develop schedules and costs for the various items of work. Inputs were provided by the ICG, thus assuring that the special interests of each member and the general public were fully known to the responsible agency. The single most critical requirement in terms of time and money was the unanimity of opinion that a data collection period of not less than one year was essential for environmental aspects. This was accepted due to the unique and controversial history of the project. The POS was finalized, published on 9 July 1974, and reviewed by members of the WPG. The POS was not an inflexible plan or interagency agreement and portions were revised as required throughout the study.

H. Request to Judge and constrained extension. On 16 July 1974, the Justice Department submitted the plan of study and accompanying papers to Judge Johnsen and requested an extension of time for completion of the restudy. On 13 August 1974, the Judge ruled in part that an extension of time would be granted only to 1 May 1975, with further application for extension of time being contingent upon explanation to the Court of why the task could not be completed by that date. An excerpt from the Judge's ruling follows:

> "The Court's opinion and Judgment dated January 31, 1974, allowed the Corps of Engineers a period of six months in which to prepare and file a study, evaluation, impact statement and recommendation on the Cross-Florida Barge Canal Project in its whole, except as some necessary extension thereof might be granted for good cause shown. The Federal defendants have filed a timely motion, with showing of cause, for an extension of this six-month period. The motion, however, seeks an extension to June 30, 1976. A blanket extension of such length ought not, in the Court's opinion, to be thus singly granted, thereby leaving the situation to stand without judicial check or safeguard as to the administrative task being carried on with due diligence and dispatch. An extension will accordingly be granted only to May 1, 1975, with any application for a further extension being required to show what has been done; what remains to be done; and that it has not been reasonably possible for the task to be physically or processively completed by May 1, 1975."

The Corps advanced schedules on all studies to the maximum extent possible to meet the 1 May 1975 deadline. However, studies underway at that time included the basic transportation-economics study, and a number of environmental investigations which were initiated in December 1974 and January 1975 and which required a data collection period of at least one year. Thus, the data collection and analysis could not be completed by 1 May 1975. Therefore, a two-track study concept was developed. Track I was directed at producing a status report by 1 May 1975 to summarize what studies had been done and what remained to be accomplished. The status report was submitted to the Court on 22 April 1975. It was reviewed by the ICG and coordinated at the Washington level prior to submission. Track II, the balance of the study, was directed at producing an objective and thorough restudy report and an accompanying EIS in full compliance with the congressional directive. After discussions of the schedule with the WPG in the fall of 1975 the Corps was requested to extend the schedule further to accommodate more detailed coordination and review at the

Washington level. A modified schedule which was submitted to the Court is attached as Appendix A. Judge Louis C. Bechtle who replaced the late Judge Harvey M. Johnsen accepted the modified schedule and ordered that the final EIS be completed no later than 21 February 1977.

II. STUDY MANAGEMENT AND PARTICIPATION

A. General. At the outset, several alternative management concepts were considered for conducting the necessary studies and preparing the environmental impact statement. Central to these considerations was the understanding that the Corps of Engineers would be responsible for the statement. The following three alternatives were considered:

1. Corps of Engineers. Preparation of the EIS by the Corps of Engineers, Jacksonville District, following prescribed procedures.

2. Interagency Task Force. EIS preparation by a Task Force comprising interested Federal and State agencies and others.

3. Consulting Service. Environmental impact assessment preparation by contract with assistance of an Interagency Coordinating Group. The responsible agency, utilizing this assessment, would prepare the draft and final EIS.

The Consulting Service approach was selected in order to insure as much as possible an objective restudy and accompanying EIS. The advantages of this concept are that it maintained single agency responsibility for the restudy, assured all agency concerns were considered early in the restudy, promoted early involvement of concerned agencies for cooperation and expeditious review, and provided the opportunity for a fresh approach through the use of an unbiased consultant without preconceived theories or position.

B. Public participation. In view of the widespread interest in the CFBC project, the POS was structured to include an intensive public involvement program. The program includes public meetings, workshops, news releases, monthly newsletters to the ICG and other public information. Public meetings and workshops were held in December 1974 at Jacksonville and at Ocala, Florida. The purposes of these meetings and workshops were to advise the public of the history of the project, the full details of the planned studies, the issues that have been raised and how the proposed studies would address those issues, and to solicit public views on the adequacy and scope of study plans. Local interests were afforded additional opportunity to ask questions

and review study plans in further detail at the workshops. Public meetings were also held in Miami, Tampa, and Palatka in June 1975 to inform the public of the status of the studies and to summarize the information provided to the court in April 1975. Workshops were held following the meetings. Public meetings are planned to be held in September 1976 to solicit public views on the Restudy Report and draft EIS.

C. Organization of report. A number of Federal and State agencies and private firms were used as consultants in preparing parts of the overall study. Appendix B lists the contractor's reports and their reproduction cost. The Corps prepared the required engineering studies and cost estimates necessary for evaluation of the alternatives. The Corps also prepared economic and environmental evaluations using consultants and other Federal and State agencies in performing the required field investigations. The Corps has prepared the following reports as parts of the overall Restudy Report effort.

1. Summary: This document discusses in summary form the results of all other study efforts.

2. Engineering: Comprehensive information on engineering design, hydraulics, lands and cost estimates for the various alternatives are included in this report.

3. Engineering, Appendix A (Geologic): This is an appendix to the Engineering Report and incorporates the plates and tables showing geologic data. This appendix also contains a reprint of the discussion of geologic data from the Engineering Report.

4. Economics: This report summarizes benefits and costs from the field contractors' reports and the costs of construction and operation of the various alternatives.

5. Environmental: The results of the contractors' field study reports are given in this report.

The Corps also prepared an environmental impact statement on the various alternatives to accompany the restudy report. These documents are listed in appendix B and are available at the cost of reproduction. They also have been placed on file for public review with the libraries listed in appendix C and forwarded to the State and Federal agencies in accordance with normal distribution procedures.

III. ALTERNATIVE PLANS CONSIDERED

A. General: Various alternative plans were developed jointly with the ICG to address the numerous issues that had been raised on the project. Basically, there are two alternatives: (1) complete the canal, and

(2) do not complete the canal. Completion plans for the canal are based on the authorized route. Subalternatives under the plan were considered for certain reaches. Alternatives investigated during this study are discussed in the following paragraphs and are described in more detail in the Scenarios (see appendix B). Supplemental Transportation Economics Studies by A. T. Kearney identified potential need for additional facilities along the canal route. The facilities would be a transloading area (see figure 46c) and a barge fleeting area at the west end of the canal and a barge port in the Silver Springs-Ocala area. The Kearney Supplemental was received after the development of the Scenarios; therefore, these new facilities were not included in the initial discussions. Information on these additional facilities was subsequently furnished to the Interagency Coordinating Group and environmental contractors for their views and comments on the environmental impacts of such facilities. Their views and comments have been incorporated in the Restudy Report and EIS.

B. Completion Alternatives.

1. Authorized Project. The authorized Cross Florida Barge Canal project (see figure 1) provides for a high-level barge canal about 110 miles long extending from the St. Johns River at Palatka to deep water in the Gulf of Mexico near Yankeetown. The project depth and width are 12 feet and 150 feet, respectively. Project works include five navigation locks 84 feet wide by 600 feet long. Other pertinent works include three reservoirs with dams and spillways, one pumping station, recreation facilities, 11 highway bridges, and two railroad crossings. Construction of the authorized project was initiated in 1964. Completed works include three locks, dams and spillways, 25 miles of canal channels, clearing of one reservoir, four bridges, bypass facilities at Inglis Lock, project office building, and some recreation facilities. The principal completed features are shown in red on figure 1. The other five "go" alternatives are modifications to the authorized project.

2. Eureka to Highway 40. This alternative would bypass about 20 miles of the Oklawaha River and a group of lakes located east of the Oklawaha River in this area. Two alinements were considered, a non-river and upland alinement. A schematic drawing of the upland alinement is shown on figure 9b. Detailed maps are contained in the Scenarios.

a. Non-river Alinement. The canal alinement would be located along the northwest fringe of the flood plain and generally parallel to the authorized alinement. Material from canal excavation and adjacent borrow areas would be used to construct a continuous levee from Eureka Dam to State Road 40 adjacent to the southeast side of the canal. A spillway would be provided to pass normal flows down the natural river channel between Highway 40 and Eureka, and a lock would be provided to maintain recreation navigation on the Oklawaha River. Engineering features include closure of the dam west of the existing lock, provision of a pumping station located between the existing lock and spillway, cutting the dam on the east side, and provision of a bridge over the cut.

b. Upland Alinement. This is basically the same as the non-river alinement plan except the canal and levee between Eureka Lock and State Road 40 would be located further to the northwest on higher ground completely out of the flood plain. The tie-in and structure arrangement just north of State Road 40 and the modification of Eureka Lock and Dam would be the same as the above plan. This plan would remove the canal alinement from the flood plain downstream of Highway 40 and maintain essentially the entire flood plain in this reach.

3. Eureka to R. N. Bert Dosh Lock. This alternative would provide a leveed barge channel from Eureka to Bert Dosh Lock along either of two alinements - non-river and upland. Detailed maps are contained in the Scenarios. Figure 10b is a schematic drawing of the Eureka to Bert Dosh Lock upland alinement.

a. Non-river Alinement. The canal alinement and engineering plans between Eureka and the vicinity of Highway 40 would be similar to those discussed in detail in the Eureka to Highway 40 scenario. South of Highway 40 the levee would extend to high ground in the vicinity of Bert Dosh Lock. This plan would maintain an additional area of the Oklawaha River Valley (Dead River Swamp) as close as possible to the natural state.

b. Upland Alinement. Here again the alinement and plans would be similar between Eureka and the vicinity of Highway 40 to those discussed in the Eureka to Highway 40 upland Scenario. South of that point the alinement of the levee and canal would be the same as the above non-river plan.

4. Summit Reach. The Summit Reach extends from Bert Dosh Lock to Dunnellon Lock, a distance of approximately 28 miles. Engineering studies have been made of numerous alternative designs with a view of minimizing the potential impacts on the existing water quality and ground water levels. Differences between the authorized plan and the alternatives include those related to water level fluctuations, canal bottom elevations and volume of water lost through leakages and seepage. The summit reach is shown on figure 130.

5. West End. These alternatives deal with the area lying west of Inglis Dam and Lock. Engineering studies have been made of numerous alternative designs with a view toward decreasing salinity conditions and improving flushing action of the lower Withlacoochee River and toward making maximum use of available water supplies. Consideration was given to providing a small craft lock on the lower Withlacoochee River. In addition to provision of this lock, the alternative included the modification of Inglis Spillway to provide slot gates in the main spillway to allow passage of floating vegetation.

6. Lake George Route. The alinement for this plan would extend from a point near Highway 40 bridge on the Oklawaha River in an east-northeast direction across the Ocala National Forest to Lake George. This alternative is seven miles longer than the authorized route and would bypass the existing Buckman and Eureka Locks and the existing channel from the St. Johns River to Lake Ocklawaha. Nine new structures--three locks, two spillways, one pumping station, and four highway bridges--would be required. Two locks, each with 20-foot lifts, would be installed at Lake George along with a spillway in a parallel channel plus a pumping station to backpump from the lake to the canal. A small lock and spillway with tieback levees would be constructed on the Oklawaha River south of State Road 40. These structures would maintain the canal pool and permit small boat navigation to the lower part of the Oklawaha River. As a result of excessive costs, this alternative was dropped early in the restudy from further consideration.

C. Non-completion alternatives.

There are three basic plans for not completing the canal: Preservation of Completed Works, Restoration to Original Condition, and Abandonment of Project. In addition to the three basic alternatives, six other non-completion plans were devised. In these six plans, various combinations of reaches are separately considered for preservation, restoration, or abandonment. These plans are shown in table 1. Federal authorization and State sponsorship would be needed to initiate any of the noncompletion alternatives. Operation and maintenance for the preserve plan could logically be assigned to the Corps. It is assumed that authority to operate and maintain Inglis Dam and Spillway under the restore or abandon plans would be obtained by a State agency.

1. Preserve Completed Works. This alternative would provide for developing and managing the completed works to maximize recreation and wildlife potential of the region. Buckman Lock would be operated and maintained as at present to allow passage of recreational boats and maintenance equipment. Rodman Dam and Spillway would be maintained and operated as at present. Inglis Lock, Spillway, and Bypass Channel Spillway and the existing barge canal channel would be operated and maintained to serve existing and potential commercial and recreational traffic. Additional recreation facilities would be provided. A schematic of the preserve alternative is shown on figure 1b.

2. Restore to Original Condition. This alternative would return the entire project area except Lake Rousseau to a natural setting insofar as possible. Structures, except highway bridges, would be removed to approximately 3.5 feet below natural ground level. Dams, except Inglis Dam and Spillway, and levees would be removed to natural ground

level. The canal would be backfilled (except the submerged gulf approach channel) and all disturbed areas restored with native vegetation. A schematic of the restore alternative is shown on figure 1c.

3. Abandonment. This alternative is shown schematically on figure 1d. Actions taken under this alternative are those required to place the project in a non-operational but safe conditions. The following actions would apply to all like structures, except where noted.

a. Locks. Lock gates, except Inglis, would be left open. Machinery would not be removed. Lock sites would be fenced.

b. Spillways. Rodman Dam and Inglis Bypass Spillway gates would be removed. Eureka Spillway gates would remain in place. Inglis Spillway would remain in operation and Lake Rousseau would be maintained at preproject conditions. All spillway areas would be fenced.

c. Canal. No action taken except at Camp Branch. Here, the canal would be plugged on both sides of the stream and the berm and levees on the south side of the barge canal would be removed as required to permit natural flow down the old streambed.

d. Reservoirs. Lake Ocklawaha would be reduced to a small fluctuating pool. Lake Rousseau would be maintained as it had been prior to the project.

With the exception of small channel enlargement at Eureka Lock and Dam, no further works would be required to alleviate potential hydrologic impacts from the Four River Basins Project. Numerous alternatives that were investigated were considered to be more environmentally and economically objectionable than future potential increases in flood hazard in local developed areas. Impacts under existing flow and development conditions are considered negligible.

4. Additional non-completion alternatives. As studies progressed on the non-completion alternatives, it became evident that additional alternative plans comprised of combinations of the above three plans should be investigated. The canal was separated into six reaches divided by the five locks on the project. The six additional alternatives presented in table 1 were selected to maximize utilization at resources such as recreational potentials, and fishing and wildlife values. An effort was also made to maximize benefits and minimize costs. Detailed information on benefits and costs for the additional alternatives is summarized in table 3 of the economics section of this report. Environmental impacts by each of the six reaches for each of the six plans can be obtained from table 2 of the Draft EIS. The Engineering Report contains detailed costs for the plans and discusses the complex problems associated with management and operation, land rights, and acquisition problems for all the non-completion alternatives. Full discussion of these matters will be presented in the formulation section of this report which will be completed following the September 1976 public meetings.

TABLE 1

ADDITIONAL NON-COMPLETION ALTERNATIVES

REACH	ALTERNATIVE 1	2	3	4	5	6
1. Palatka to Buckman Lock	Preserve	Preserve	Abandon	Abandon	Abandon	Abandon
2. Buckman Lock to Eureka Lock	Preserve	Preserve	Preserve	Restore	Preserve	Preserve
3. Eureka Lock to Bert Dosh Lock	Abandon	Restore	Restore	Restore	Restore	Abandon
4. Bert Dosh Lock to Dunnellon Lock	Abandon	Abandon	Abandon	Abandon	Abandon	Abandon
5. Dunnellon Lock to Inglis Lock	Preserve	Preserve	Preserve	Preserve	Preserve	Preserve
6. Inglis Lock to Gulf End	Preserve	Abandon	Preserve	Abandon	Abandon	Abandon

IV. DISCUSSION OF ENVIRONMENTAL ASPECTS

A. General. Environmental studies were conducted to evaluate the impacts of the various alternatives. A listing of the studies is contained in appendix B. The projected impacts of the various alternatives on the canal region ecosystem are presented in the individual reports and the draft environmental impact statement. A summary of the impacts is presented in the following paragraphs and in table 4.

B. Impact of completion alternatives. The impacts of the completion alternatives would depend on the impact category and alternative selected. The socioeconomic impacts would not differ appreciably among the alternatives since the project would have little overall effect on the socioeconomic characteristics of the region. The project would provide transportation savings benefits to shippers of certain commercial products along the eastern and gulf coasts and inland waterways connecting the coasts. The counties adjacent to the canal have incorporated completion of the project in their plans as a probable stimulus to industrial development and any change from the authorized alinement would affect future land use plans. Project-associated structures would provide recreation, fish and wildlife, and flood control benefits. Total regional employment would be increased relative to conditions without the canal by up to 11 percent. A study of the air quality conditions of the project area shows that completion of the project by any of the alternatives would not affect the air quality in the area. Hydrologic studies show that by 2035 A.D., under drought conditions, canal operation would compete with wildlife, recreation, balanced ecosystem interests, and economic development for water supply. With average and wet year conditions annual flows would not be substantially reduced by canal operations or water demands associated with economic development.

Generally, impoundment of waters, as contemplated under these alternatives, will raise ground water levels for short distances around the impoundments and will reduce concentrations of dissolved solids (chlorides and hardness ions) in the aquifer. These effects result from exchange of water between the canal and the aquifer. No further impacts on ground water are anticipated although the potential of a spill contaminating the aquifer will exist. Soluble substances, if spilled in the Summit Reach, would enter the aquifer but rapid cleanup response will reduce this hazard.

Impacts of the completion alternatives on water quality will vary. During construction, State standards for turbidity and dissolved oxygen for Class IV and higher waters may not be met in the immediate areas of dredging. Similar conditions may occur for short periods of time during maintenance dredging in the immediate

area of the dredging. Water quality changes from calcium and magnesium sulfate water to calcium carbonate water will occur under the authorized alternative in Mud and Eaton Lakes. Suspended solids will settle in Eureka Pool, causing reduced input to Lake Ocklawaha. Dissolved oxygen demand associated with sediments and decaying vegetation may deplete oxygen at lower levels in the lakes. Deep parts of the lakes may become seasonally oxygen deficient.

Aquatic plants will pose a persistent problem for all except navigation and recreation uses of reservoir waters. The magnitude of the problem will be proportional to the area of surface water in the project area. An alternative having the least area of surface water is least troublesome. In channel and canal areas, vessel traffic will keep channels open, but chemical, biological, or physical control measures would be required in order to keep the reservoirs suitable for multiple uses. Nutrient studies indicate that nutrient supplies are favorable to copious growths of aquatic plants. However, the long-term effects are not likely to be substantially different from problems experienced today. A plan for the control of aquatic weeds has been developed and the attendant costs included in development of the benefit-cost ratio.

The Oklawaha River Basin ecosystem would be lost as an entity along with the river fishery and river reptiles and invertebrates under the authorized alternative. These would be replaced with a reservoir ecosystem. Newly impounded water would cover smaller areas under the non-river alternatives and still smaller areas under upland alternatives. A reservoir sport fishery would be increased in varying degrees, depending on the alternative selected. Under the authorized alternative, additional habitat would be created by river impoundment for the southern bald eagle, osprey, herons and egrets, anhinga, limpkin, ducks, and American alligator. Other completion alternatives would provide lesser amounts of additional habitat. A temporary flooded tree habitat would benefit red-headed woodpecker and wood duck before the trees fall. Ducks, coot, and common gallinule would temporarily benefit from standing flooded timber stages. Conditions of climate and natural water quality will combine to produce dense aquatic plant growth in relatively shallow areas of the reservoirs. River plant communities will change from spatterdock and emergent shoreline communities to hydrilla and other submersed aquatics. Plant control operations will be required for the project life. Disposal islands in the Gulf of Mexico will continue to benefit nesting diamondback terrapin and sea birds. Small common amphibians and reptiles will use the reservoirs and disposal islands that may be created in the reservoirs.

A total of 25,800 acres of productive forest land would be permanently lost under the authorized alternative, along with 4,800 acres of unclassified forest, and 4,000 acres of non-forest land. Commercial timber which will be cut and no longer produced is presently valued at $8,650,000. Fifteen endangered or threatened species would lose habitat while two would be benefited. Acreage includes

escape cover for deer, bear, and turkey, and is the area most used in the region by hunters. The Upland, Eureka to Bert Dosh Lock alternative would permanently remove 2,800 acres of productive forest land, 150 acres of unclassified forest land, and 600 acres of non-forest land. Most deer, bear, and turkey habitat and hunting area would be retained for the short-term. Impacts of the other completion alternatives on the terrestrial ecosystem would fall between the two above extremes. In all alternatives, cave crustaceans and a bat colony would be extirpated or displaced, respectively, and spring molluscs and crustaceans would be extirpated from the area, and potential for manatee-barge collisions would be increased.

C. Impacts of non-completion alternatives. Counties adjacent to the project have incorporated completion of the canal in their land use plans. Thus, alternatives for non-completion would require adjustment of those plans with accompanying impacts. Any alternative that does not involve construction of the canal brings into question the use of lands acquired for that purpose in fee simple or by easement agreements. Socioeconomic impacts of the non-completion alternatives would differ little from the completion alternatives. Air quality impacts would also differ only slightly, if at all.

Under the Preserve alternative, as under the build alternatives, Lakes Ocklawaha and Rousseau could be intensively managed for aquatic weed control, fisheries, wildlife, and recreation. If Lake Ocklawaha were raised to 20 feet, m.s.l., some escape cover now used by bear and deer would be flooded, and 13 endangered or threatened species would lose habitat while four would gain. Under the Restore alternative, the river fishery and ecosystem would be restored and reservoir fishes would be displaced into the rivers. Except for a residual 600-acre pool behind Rodman Dam, the Abandon alternative would produce impacts little different from Restore. The Restore and Abandon alternatives would result in loss of the Lake Ocklawaha fishery, waterfowl, and recreation resource and habitat for alligator, southern bald eagle, osprey, herons, bitterns and egrets, anhinga, limpkin, and ducks; 12 endangered or threatened species gain habitat while four lose habitat as the forest ecosystem is restored as a diversified entity.

The impacts of the non-completion alternatives on water quality would depend on management programs adopted for the remaining resources. For example, under the Preserve alternative, seasonal oxygen deficits in Lake Ocklawaha associated with thermal stratification and abundant plant growth may be aggravated by weed management drawdowns. Under the Restore alternative, the Oklawaha River would gradually return to a condition of pre-impoundment water quality. Little effect on the Withlacoochee below Lake Rousseau would be evident. Salinity of ground water below the present West End cut would be reduced and the ground water quality would approach pre-canal conditions. Hydrilla growth would increase above the lock (alternative) at Yankeetown, requiring the initiation of plant control operations. Movement of fishes and crabs into the river in the colder months would be blocked by the lock under the West End alternative, manatee range would be reduced and river reptiles would be replaced by lake-adapted species.

By mixing non-build alternatives among reaches a broader spectrum of options becomes available for consideration. The impact of any derived alternative is the sum of impacts from all reaches. Impacts of each alternative in each reach are outlined in table 2 of the environmental impact statement.

D. Impact on endangered or threatened species. Plants listed by the U. S. Department of the Interior as endangered, and which occur in the canal area, are water parsnip, Dicerandra frutescens,* and coontie. Listed as threatened are needle palm, silk bay, and quillwort. Plants listed by the State of Florida are Venus-hair fern, buckthorn, white arrow arum, and sundew. Pine sap, located within the canal area, is identified in the Wildlife Report as a species of special interest because there is only one previous record of the plant in the State. Two of these plants will have populations reduced by the Authorized alternative. Other completion alternatives generally do not threaten these plants, but secondary development and human activities are potential threats which are likely to occur with or without the canal. Animals of the canal region which are listed by the U. S. Department of the Interior as endangered are the American alligator, eastern short-tailed snake, red-cockaded woodpecker, brown pelican, southern bald eagle, Florida sandhill crane, Florida panther, and manatee. Listed as threatened by the State of Florida are the wood stork, snowy plover, osprey, little kestrel, American oystercatcher, least tern, Florida scrub jay, loggerhead turtle, Suwannee cooter, Florida gopher tortoise, eastern indigo snake, sand skink, Florida gopher frog, Sherman's fox squirrel, Florida mouse, Florida black bear, and Florida weasel. Generally, the freshwater associated species would be benefited by reservoir construction and damaged by reservoir drainage, and the dry habitat species would be damaged by reservoir construction. One red-cockaded woodpecker clan site would be destroyed, another partly destroyed and two others indirectly affected by vegetative changes under the completion alternatives. Black bear and Florida panther habitat would receive major reduction with the Authorized alinement. Reduction of manatee population could result from collisions with boats and barges. None of the project area is declared critical habitat for any endangered species but proposed rulemaking for manatee has been issued by the Director of the U. S. Fish and Wildlife Service. CFBC area affected would be the Crystal River on the West End and the St. Johns River on the eastern side.

V. ENGINEERING ASPECTS OF VARIOUS ALTERNATIVES

A. Introduction. Engineering studies were conducted to develop plans and cost estimates for the various alternatives. This work included field surveys, new hydrologic and hydraulic design, foundation and seepage studies, and cost estimates for the various alternative plans. Investigations conducted in various areas are discussed in the following paragraphs.

*A small, woody mint, no common name.

B. Field surveys. Field hydrographic and geographic surveys needed to prepare detailed cost estimates have been completed for the entire project. The principal surveys were profiles and cross sections required to adequately study the Eureka Reach non-river and upland alinements. Additional surveys were made in Lake Ocklawaha to develop an adequate contour map between elevations 11 and 20 feet in the Summit Reach to locate pump test sites, and in Rainbow River and Blue Run to gather hydrographic data.

C. Hydrologic and hydraulic design. Basic hydrological data were reviewed and updated to ascertain the effects of project construction to date and to evaluate the effects of existing and prospective development and changes in the regimen of runoff in the tributary area which would result from each of the alternatives under consideration. These include runoff rates, point inflow data, area-capacity relations, reservoir routings, design capacities for spillways, lockage demands, pumping station sizes, availability of water supplies for the pumps, and probable seepage losses where significant head differentials can be expected. Hydrologic and hydraulic design studies were needed to evaluate options based on not constructing the barge canal. These included study of alternative flood outlet facilities for Oklawaha and Withlacoochee River areas of the Four River Basins Project.

D. Foundation and seepage studies. Foundation investigations including core borings were performed. These investigations were made to determine materials to be excavated, materials available for levee construction, and foundations of structures necessary for detailed designs of the alternate plans. Borrow areas were located to provide materials needed to supplement the canal excavation for embankment construction. Dry-rod probings were taken along the proposed levee alinements and canal cross sections in areas of peat and other unsuitable materials to determine thicknesses and extent of soft compressible soils. Samples of typical materials along the canal alinement and from the borrow areas were obtained and evaluated. Field pumping tests were made in the principal outflow zone from the Summit Reach to the aquifer south of Silver Springs. Studies were conducted jointly with the U.S. Geological Survey. Data derived were used for detailed quantitative analyses of ground water hydraulic characteristics, including flow volumes and rates.

E. Cost estimates. Studies of the various alternative plans included designs and cross section analyses of channel and levee designs to properly estimate costs. Site plans for locks, spillways, and pumping stations were developed as necessary to establish foundation conditions and construction procedures. Adequate analyses necessary to arrive at the most feasible structure designs were made. Cost estimates for the various alternatives are summarized on tables 2 and 3. Land costs

used are actual acquisition costs for acquired lands and present value for lands yet to be acquired. Cost estimates for all plans including the non-construct alternatives include estimates of costs for additional recreation facilities as presented in the Recreation Study Report.

F. Interest rates. Average annual charges and benefits have been computed for three interest rates. The interest rate of 2-7/8 percent was the rate in effect for Fiscal Year 1964, the year in which construction appropriations were first provided for the CFBC project. Pursuant to Section 80(b) of the Water Resources Development Act of 1974, 2-7/8 percent is the legal interest rate to be used in evaluating the feasibility of constructing the CFBC project, as authorized. The interest rate of 6-1/8 percent is the rate in effect for Fiscal Year 1976 for plan formulation, evaluation, cost allocations, and reimbursement studies for new project proposals. Computations based on this interest rate are shown to provide data for the Cross Florida Barge Canal project comparable to that for new project decisions. The interest rate of 6-7/8 percent was the interest rate proposed in September 1973 by the Water Resources Council for application under the Principles and Standards for planning water and related land resource projects. That rate was rejected by Section 80 of the Water Resources Development Act of 1974. However, the plan of study for the restudy indicated that 6-7/8 percent will be used as the upper range of interest rates to demonstrate the sensitivity of project analysis to various interest rates.

VI. ECONOMIC ASPECTS OF VARIOUS ALTERNATIVES

A. Background. The Cross Florida Barge Canal was subject to a number of benefit-cost studies prior to the initiation of construction. Each of these studies resulted in a favorable benefit-cost ratio. The principal studies were:

1. "Economic Restudy of the Cross Florida Barge Canal," 10 January 1958, Jacksonville District, Corps of Engineers. The study resulted in a benefit-to-cost ratio (BCR) of 1.05.

2. "Economic Evaluation Report of the Cross Florida Barge Canal," 13 March 1962, Jacksonville District, Corps of Engineers. The study resulted in a BCR of 1.01.

3. "Potential Traffic and Transportation Cost Savings of the Cross Florida Barge Canal," March 1962, Arthur D. Little, Inc. This study and the 1962 study by the Jacksonville District were utilized by the Chief of Engineers in June 1962 to prepare a study entitled "Cross Florida Barge Canal, Chief of Engineers Evaluation." The study produced a BCR of 1.17.

B. Alternatives considered. Benefits and cost data were developed for each of the alternative courses of action as previously described in Section III, Alternative Plans Considered, except for the West End and the Lake George alternatives. The West End alternatives were eliminated due to increased cost with negligible benefits and resultant environmental losses. The Lake George alternative was eliminated from further consideration early in the restudy due to excessive costs.

C. Costs and benefits. As stated above, average annual charges and benefits were computed for three interest rates. Average annual charges and benefits are summarized for all alternatives and interest rates in table 2.

D. Benefit studies. Transportation benefits were developed by a consultant, A. T. Kearney Co.; flood control benefits by the Corps of Engineers, U. S. Army; recreation use by the Bureau of Outdoor Recreation, Department of Interior, and recreation benefits by the Corps, and fish and wildlife benefits by the Corps based on data developed under contract by Meta Systems and the Florida Game and Fresh Water Fish Commission. An analysis of the socioeconomic impacts of the various alternatives was made by Meta Systems, Inc. The fundamentals of each of these benefit analyses are contained in the following paragraphs.

1. Transportation. The A. T. Kearney Co. determined transportation benefits in accordance with regulations prescribed by the Corps of Engineers, U. S. Army, in conformance with the Transportation Act of 1966. In addition. A. T. Kearney determined that a transloading facility located at the western end of the Cross Florida Barge Canal would enhance the project operation by allowing the utilization of deep-draft barges for the Gulf portion of certain commodity movements. The transportation benefit estimates are shown in tables 2 and 3.

The economics report discusses several additional potential moves on the CFBC. In light of the national concern over future energy sources, potential coal moves were studied by A. T. Kearney. Shipments to the southeast would be primarily over long-haul distances and transportation economics would be favorable to barge transportation when origin and destination points are on the water. Primary sources of coal are the Ohio Valley, Alabama and the western states. Most of these major coal mining regions in the Ohio Valley and Alabama are on or near the Mississippi, Ohio, Green, Cumberland, Tennessee-Tombigbee, Black Warrior, and Alabama River systems. The location of coal sources appears to indicate potential coal movements via the CFBC from the primary source regions to the Florida east coast and the south Atlantic east coast. The FEA recently published a list of plants under construction which are candidates for

coal-firing equipment and existing plants which are candidates for conversion. Some of the plants on this list are located along the Florida east coast and south Atlantic east coast. The possible use of 800,000 tons of coal per year by the Jacksonville Electric Authority (JEA) could generate approximately $2,000,000 in first-year transportation savings. However, no coal benefits were claimed in the benefit base since the JEA nor other south Atlantic east coast utility companies could provide definitive information about future usage at this time.

2. Flood control. Analyses made by the Corps of Engineers indicate that flood control benefits would be small and would occur in only the Withlacoochee River at Dunnellon. The completion alternatives result in a flood control benefit of $2,400 for all alternatives. The "restore to original condition" alternative results in a disbenefit of $600. The "preserve" and "abandon" alternatives have no effect on flood stages.

3. Recreation. Basic information on recreation use was provided by the Bureau of Outdoor Recreation, Department of the Interior. Recreation needs, consistent with the final draft of the 1976 Statewide Comprehensive Outdoor Recreation Plan for Florida, were developed and projected for the Cross Florida Barge Canal area through 2035. Projections of user occasions for each alternative were computed on the basis of capacity use of the facilities provided. The recreation benefit estimates developed by the Corps represent net additional benefits over and above existing use and are shown in tables 2 and 3. The BOR also identified the need for a sand beach on the lower Withlacoochee River. Intensive environmental mitigation would be required because of the unique nature of the area, therefore no benefits have been included for such a recreation beach. This recreation potential will be given further consideration should the project completion be recommended.

4. Fish and wildlife. The basic work dealing with fish and wildlife resources was conducted under contract with the Florida Game and Fresh Water Fish Commission. Two separate contractual arrangements were instituted; one dealing with the evaluation of the impact of the alternatives on fisheries, the other dealing with the impact of the alternatives on wildlife. Meta Systems, Inc., developed rankings of the various alternatives for fishing and hunting. The basic data developed by Meta Systems were used by the Corps of Engineers to estimate fish and wildlife benefits for the various alternatives. Average annual equivalent benefits are computed by subtracting estimated value of current use under the preserve plan from the estimated value of use expected under each alternative. It has been assumed that existing fishing effort per acre will be maintained over the life of the project. The benefits thus derived are the same for all interest rates and are shown in tables 2 and 3.

5. Socioeconomics. Meta Systems analyzed the potential socioeconomic impacts of completing the Cross Florida Barge Canal. Their studies indicate that the number of people likely to come to the region or be employed as a result of decisions that are related to the completion of the canal is relatively small. Construction of the canal would bring substantial new income into the area, but the influx of workers would not create a significant problem in terms of services. Over the long term, the population density would increase slightly, but would be well below the average density of Florida. There would be some expansion of the urban areas and a considerable amount of more diffuse development. The demand for and costs of services generally would increase only slightly, and in some cases per capita costs of services can be expected to decrease. Land-use patterns would not be significantly affected except in certain areas in the immediate vicinity of the canal, and the settlement patterns, including large residential developments near towns, particularly Ocala, would be impacted in that they would fill up a little faster in the with-canal case than in the without-canal case. The social and economic impacts associated with completion of the canal are not large compared to the changes in the region anticipated without the canal. Completion of the canal would likely act as a modest stimulant to growth, increasing the rate at which development occurs, but could not significantly change the character or level of economic growth in the region.

6. Summary of economic benefits and costs. The estimates of transportation, flood control, recreation, and fish and wildlife benefits associated with each alternative are shown in tables 2 and 3 at interest rates of 2-7/8 percent, 6-1/8 percent, and 6-7/8 percent. The annual charges for each alternative are also shown for the three interest rates. Average annual benefits and costs including benefits and costs associated with completed works are shown at an interest rate of 2-7/8 percent.

VII. EFFECTS OF ALTERNATIVE ACTIONS

To bring the effects and impacts of this complete study effort into a single table is an impossibility. However, table 4 is an attempt to highlight some of the major effects and to provide an understanding of the scope and quantification of the engineering, environmental, and socioeconomic implications of the various alternatives. More detailed environmental information on all of the alternatives is presented in table 2 of the Draft Environmental Impact Statement.

Table 2

Summary of Benefits and Costs for the "Construct" Alternatives*
($000)

Interest Rate	Benefit-Cost Items	Authorized Alinement	Eureka HW40 Non-River Alinement	Eureka HW40 Upland Alinement	Eureka-Bert Dosh Non-River Alinement	Eureka-Bert Dosh Upland Alinement
	Annual Benefits					
	Transportation Benefits	13,414	13,414	13,414	13,414	13,414
	Flood Control Benefits	2	2	2	2	2
	Recreation Benefits[A]	3,802	3,802	3,802	3,802	3,802
	Fish and Wildlife Benefits	207	94	75	74	56
	Total	17,425	17,312	17,293	17,292	17,274
2-7/8%	Annual Costs[B]					
	Authorized Summit Reach	14,083	14,557	14,960	14,550	14,996
	Alternative Summit Reach	13,581	14,056	14,449	14,049	14,495
	Benefit-Cost Ratios					
	Authorized Summit Reach	1.24	1.19	1.16	1.18	1.15
	Alternative Summit Reach	1.28	1.23	1.20	1.23	1.19
	Annual Benefits					
	Transportation Benefits	12,053	12,053	12,053	12,053	12,053
	Flood Control Benefits	2	2	2	2	2
	Recreation Benefits[A]	3,533	3,533	3,533	3,533	3,533
	Fish and Wildlife Benefits	207	94	75	74	56
	Total	15,795	15,682	15,663	15,662	15,644
6-1/8%	Annual Costs[B]					
	Authorized Summit Reach	23,765	24,560	25,270	24,536	25,345
	Alternative Summit Reach	22,824	23,593	24,329	23,595	24,404
	Benefit-Cost Ratios					
	Authorized Summit Reach	.66	.64	.62	.64	.62
	Alternative Summit Reach	.69	.66	.64	.66	.64
	Annual Benefits					
	Transportation Benefits	11,811	11,811	11,811	11,811	11,811
	Flood Control Benefits	2	2	2	2	2
	Recreation Benefits[A]	3,463	3,463	3,463	3,463	3,463
	Fish and Wildlife Benefits	207	94	75	74	56
	Total	15,483	15,370	15,351	15,350	15,332
6-7/8%	Annual Costs[B]					
	Authorized Summit Reach	26,424	27,301	28,105	27,280	28,190
	Alternative Summit Reach	25,363	26,212	27,044	26,219	27,128
	Benefit Cost Ratios					
	Authorized Summit Reach	.59	.56	.55	.56	.54
	Alternative Summit Reach	.61	.59	.57	.59	.57
	Annual Benefits[C]					
	Transportation Benefits	13,414	13,414	13,414	13,414	13,414
	Flood Control Benefits	3	3	3	3	3
	Recreation Benefits	4,465	4,465	4,465	4,465	4,465
	Fish and Wildlife Benefits	1,161	1,048	1,029	1,028	1,010
	Total	19,043	18,930	18,911	18,910	18,892
2-7/8%	Annual Costs[B,D]					
	Authorized Summit Reach	18,664	19,136	19,531	19,131	19,576
	Alternative Summit Reach	18,162	18,637	19,029	18,630	19,075
	Benefit-Cost Ratios					
	Authorized Summit Reach	1.02	.99	.97	.99	.97
	Alternative Summit Reach	1.05	1.02	.99	1.02	.99

[A] Recreation benefits economically independent of other benefit categories of $2,617, $2,460 and $2,432 at interest rates of 2-7/8%, 6-1/8% and 6-7/8%, respectively, are included in the recreation benefit estimates. The associated costs of $520, $675 and $715 are included in the cost estimates. These are for providing facilities at existing project works.

[B] The cost estimate includes costs for access to a Transloading Facility at Florida Power Corporation. Average annual costs at interest rates of 2-7/8% 6-1/8% and 6-7/8% are $316, $425, and $452, respectively. An alternative of deepening of the CFBC access channel to 20 feet would be more expensive.

[C] Includes benefits associated with completed works.

[D] Includes costs associated with completed works.

*See page 17 for a discussion of the interest rates used.

Table 3

Summary of Benefits and Costs for the "Do Not Construct" Alternatives*
($000)

Interest Rate	Benefit-Cost Items	Preserve	Restore	Abandon	Other Alternatives[A] 1	2	3	4	5	6
	Annual Benefits									
	Flood Control	-	-1	-	-	-1	-	-1	-1	-1
	Recreation	2,875	1,196	598	2,875	1,743	3,264	1,790	1,743	1,354
	Fish and Wildlife	-	230	-55	-	121	121	138	121	-
2-7/8%	Total	2,875	1,425	543	2,875	1,863	3,385	1,927	1,863	1,353
	Annual Costs	1,866	2,377	907	1,811	1,783	1,980	1,882	1,857	1,588
	Benefit-Cost Ratios	1.54	.60	.60	1.59	1.04	1.71	1.02	1.00	.85
	Annual Benefits									
	Flood Control	-	-1	-	-	-1	-	-1	-1	-1
	Recreation	2,624	987	454	2,624	1,537	3,038	1,525	1,537	1,123
	Fish and Wildlife	-	230	-55	-	121	121	138	121	-
6-1/8%	Total	2,624	1,216	399	2,624	1,657	3,159	1,662	1,657	1,122
	Annual Costs	2,431	3,846	1,351	2,369	2,395	2,636	2,818	2,530	2,099
	Benefit-Cost Ratios	1.08	.43	.30	1.11	.69	1.20	.59	.65	.53
	Annual Benefits									
	Flood Control	-	-1	-	-	-1	-	-1	-1	-1
	Recreation	2,578	949	428	2,578	1,498	2,996	1,477	1,498	1,080
	Fish and Wildlife	-	230	-55	-	121	121	138	121	-
6-7/8%	Total	2,578	1,178	373	2,578	1,618	3,117	1,614	1,618	1,079
	Annual Costs	2,575	4,219	1,464	2,511	2,550	2,803	3,056	2,701	2,229
	Benefit-Cost Ratios	1.00	.28	.25	1.03	.63	1.11	.53	.60	.48
	Annual Benefits[B]									
	Flood Control	1	-	1	1	1	2	1	1	1
	Recreation	3,538	1,859	1,261	3,538	2,406	3,927	2,453	2,406	2,017
	Fish and Wildlife	954	1,184	1,009	954	1,075	1,075	1,092	1,075	954
2-7/8	Total	4,493	3,043	2,270	4,493	3,481	5,003	3,545	3,481	2,971
	Annual Costs[C]	5,416	5,927	4,457	5,361	5,333	5,529	5,432	5,407	5,138
	Benefit-Cost Ratios	.83	.51	.51	.84	.65	.90	.65	.64	.58

[A]See table 1 for a description of these alternatives.

[B]Includes benefits associated with completed works.

[C]Includes costs associated with completed works.

*See page 17 for a discussion of the interest rates used.

TABLE 4

REPRESENTATIVE DIRECT ENVIRONMENTAL, SOCIOECONOMIC, AND ENGINEERING EFFECTS OF CFBC ALTERNATIVE ACTIONS

ALTERNATIVE	ENGINEERING	ENVIRONMENTAL EFFECTS		SOCIOECONOMIC EFFECTS
Authorized	Construction of two locks, one pumping station, nine bridges, clearing in Eureka Pool, impound river at Eureka Dam, excavate 84 miles of canal	Gained: 20,396 acres of reservoir, $207,000 fish and wildlife benefits, $3,801,000 to $3,463,000 recreation benefits. Habitat and individuals of two endangered species. Potential adverse ground water effects if pollutant spilled. Aquatic plant control required for 32,357 acres.	Lost: (Disposal, excavation, flooding, water table elevation): 40,755 acres of non-reservoir lands, 595 acres of river-run, $8,650,000 renewable commercial timber. Habitat and individuals of 16 endangered and threatened species.	Transportation benefits from $13,414,000 to $11,811,000 depending on interest rate. Total employment increased by 6% in 1990 and by 11% in 2030, over without canal baseline conditions. Total personal income will increase by 10%. Annual per capita water and sewer services costs, 1975-2035, decreased by $1.00 for Citrus County, increased by $.80 for Levy, Marion, and Putnam Counties.
Eureka to Highway 40 Non-River Alinement*	Same as authorized alinement plus one additional lock and spillway, two additional pumping stations, reduced area in Eureka Pool, 12 miles of levee, and no diversion of water between river basins.	8,827 acres of reservoir, $94,000 fish and wildlife benefits, $3,801,000 to $3,463,000 recreation benefits. Habitat and individuals of two endangered species. Potential adverse ground water effects if pollutant spilled. Aquatic plant control required for 20,788 surface acres.	32,533 acres non-reservoir lands, 224 acres of river-run, $6,345,000 renewable commercial timber. Habitat and individuals of 14 endangered or threatened species.	Same as for Authorized alternative.

*Impact quantities are those of Eureka Reach Alternative plus those of Authorized Alternative for all other reaches.

TABLE 4 (Continued)

ALTERNATIVES	ENGINEERING	ENVIRONMENTAL EFFECTS		SOCIOECONOMIC EFFECTS
Eureka to Highway 40 Upland Alinement*	Same as Eureka to Highway 40 non-river alinement except further reduction in Eureka Pool area and reduced levee requirement.	Gained: 7,471 acres of reservoir, $75,000 fish and wildlife benefits, $3,801,000 to $3,463,000 recreation benefits. Habitat and individuals of one endangered species.	Lost: 32,006 acres non-reservoir lands, 215 acres of river-run, $6,145,000 renewable commercial timber. Habitat and/or individuals of 14 endangered or threatened species.	Same as for Authorized Alinement.
		Potential adverse ground water effects somewhat less than under Authorized and Non-River alternatives. Aquatic plant control required for 19,432 surface acres.		
Eureka to Bert Dosh Non-River Alinement*	Same as Eureka to Highway 40 non-river alinement except no flooding of Dead River Swamp plus three additional miles of levee.	6,816 acres of reservoir, $74,000 fish and wildlife benefits, $3,801,000 to $3,463,000 recreation benefits. Habitat and individuals of one endangered species.	22,383 acres non-reservoir lands, 151 acres of river-run, $3,910,000 renewable commercial timber. Habitat and/or individuals of 14 endangered or threatened species.	Same as for Authorized Alinement.
		Potential adverse ground water effects if pollutant spilled. Aquatic plant control required for 18,777 surface acres.		
Eureka to Bert Dosh Upland Alinement*	Same as Eureka to Highway 40 upland alinement except no flooding in Dead River Swamp plus three additional miles of levee.	5,579 acres of reservoir, $56,000 fish and wildlife benefits, $3,801,000 to $3,463,000 recreation benefits.	21,920 acres of non-reservoir lands, 142 acres of river-run, $3,755,000 renewable commercial timber. Habitat and/or individuals of 14 endangered or threatened species (none gained).	
		Potential adverse ground water effects somewhat less than under Authorized and Non-River alternatives. Aquatic plant control required for 17,450 surface acres.		

*Impact quantities are those of Eureka Reach Alternative plus those of Authorized Alternative in all other reaches.

TABLE 4 (Continued)

ALTERNATIVES	ENGINEERING	ENVIRONMENTAL EFFECTS		SOCIOECONOMIC EFFECTS
Summit Reach*	Raise canal bottom thereby reducing canal excavation; less quantity of concrete in locks, and smaller lock gates.	Gained: Less potential for ground water pollution than under Authorized alternatiive. Essentially little other difference. Additional effects corresponding to other reach alternative(s) selected.	Lost:	No change from Authorized alternative conditions.
West End*	Provide one additional lock and spillway.	Increased aquatic weed problem above lock. Additional effects corresponding to other reach alternative(s) selected. Habitat and individuals potentially reduced for six endangered or threatened species; increased for none.		No change from Authorized alternative conditions.
Preserve	Remove channel restrictions at Eureka in vicinity of old State Road 316 bridge.	$2,875,000 to $2,578,000 recreation benefits. Habitat and individuals of four endangered or threatened species.	Some escape cover now used by deer, bear, and turkey to be flooded. Habitat and individuals of 13 endangered or threatened species.	Population increases in canal counties smaller than under build alternatives; per capita annual water and sewer cost increases smaller; total employment and personal income increases smaller. Lake Ocklawaha recreation resource preserved.
		Aquatic plant control required for 11,961 surface acres.		
Restore	Canal would be backfilled (except the submerged gulf channel) three locks, dams, and spillways would be removed and area vegetated by grassing and planting.	7,893 acres non-reservoir lands, 400 acres of river-run, $230,000 fish and wildlife benefits, $412,000 to $160,000 recreation benefits. Habitat and individuals of 12 endangered or threatened species.	8,060 acres of reservoir. Habitat and individuals of four endangered or threatened species.	Lake Ocklawaha recreation resource lost, forest gained. Other effects similar to Preserve alternative
		Aquatic plant control required for 3,901 surface acres.		
Abandon**	Place structures in non-operating condition (except Inglis Dam and Spillway). Provide safety fencing at locks and spillways.	5,761 acres of non-reservoir lands, 300 acres river-run, $598,000 to $387,000 recreation benefits. Habitat and individuals of 12 endangered or threatened species.	6,060 acres of reservoir, $55,000 fish and wildlife benefits. Habitat and individuals of four endangered or threatened species.	Lake Ocklawaha recreation resource lost, forest gained. Other effects similar to preserve alternative.
		Aquatic plant control required for 5,901 surface acres.		

*Additional impacts in other reaches are as described in the foregoing parts of this table.
** Abandon becomes essentially like Restore in terms of habitat effects if the Rodman Dam still is removed or the dam breached.

VIII. MAJOR ISSUES

Many issues and questions have surfaced during the history of the Cross Florida Barge Canal project. These issues concerned geology, hydrology, ecology, land use, canal construction and operation, and economics. One of the purposes of the restudy report was to address the major issues and questions. Thus, the issues were utilized in determining the various alternative plans for study and in planning the environmental, engineering, and economic investigations to be undertaken. The major issues and responses are discussed in appendix D and have been incorporated where appropriate in the individual environmental, engineering, and economic reports.

IX. PROJECT FORMULATION FUTURE STEPS IN THE STUDY

A. General. In order to assure maximum public and Federal and State agency inputs to the studies of the Cross Florida Barge Canal, the Restudy Report and accompanying draft Environmental Impact Statement, have addressed all alternatives equally. No recommended plan of action has been selected. As the Restudy Report and draft EIS are reviewed, both documents will be refined in an iterative process until an alternative is chosen and the Final Restudy Report and the Final EIS are submitted to the Congress, the court, and the Council on Environmental Quality (CEQ). The final Restudy Report will include a formulation section which will discuss in detail at the management and operational aspects of all alternatives. The schedule for overall remaining study effort is shown in appendix A. Dr. R. D. North, of the University of Georgia, prepared a report on alternatives for a Highest and Best-Use Study of the Oklawaha River Basin and Lake Rousseau. This study was funded by the Environmental Protection Agency and presents several alternative futures for the area. Dr. North's study was received too late for detailed consideration and presentation in this report. However, several of his plans are compatible with various non-construct alternatives included in this report. A positive plan for the area would be required to solve land rights problems in the absence of the canal project. Further consideration will be given Dr. North's study as work progresses. Public and agency comment on his work is solicited. The following paragraphs discuss the steps involved in completing the required Restudy Report and EIS by 21 February 1977, as ordered by the court.

B. ICG review. During the period 25 June to 12 July 1976, the Draft Restudy Report and Draft EIS was reviewed by members of the ICG. They provided their views and comments to the Corps of Engineers. The Corps subsequently revised the studies as necessary. Further comment from the ICG will be accepted through the period of public review which will end on or about 4 October 1976.

C. Public review. On 20 August 1976 the Corps distributed a public notice announcing the availability of the Draft Restudy Report and Draft EIS for public review. On the same date the Corps filed the Draft EIS with the CEQ. Public comments will be required within 45 days.

D. Public meetings. During the period 17-28 September 1976, a series of public meetings will be held at Jacksonville, Palatka, Ocala, Crystal River, Tampa, Miami, and Orlando. At the public meetings the Corps will provide information relative to the beneficial and adverse effects of all alternatives and discuss the engineering, economic, and environmental implication of each plan.

E. Preparation of Final Restudy Report and Final EIS. Following the public meetings, the Corps will initiate preparation of the Final Restudy Report and the Final EIS considering information obtained and views expressed. This will be a process of reiteration following review by South Atlantic Division (SAD), Office, Chief of Engineers (OCE), Secretary of the Army (SA), and the Washington Policy Group (WPG). A Final Restudy report and Final EIS on a selected course of action will be prepared during the period 14 January-1 February 1977. Beginning 1 February, the Report and EIS will be retyped and reproduced for distribution to the Congress, the court, and the CEQ by 21 February 1977.

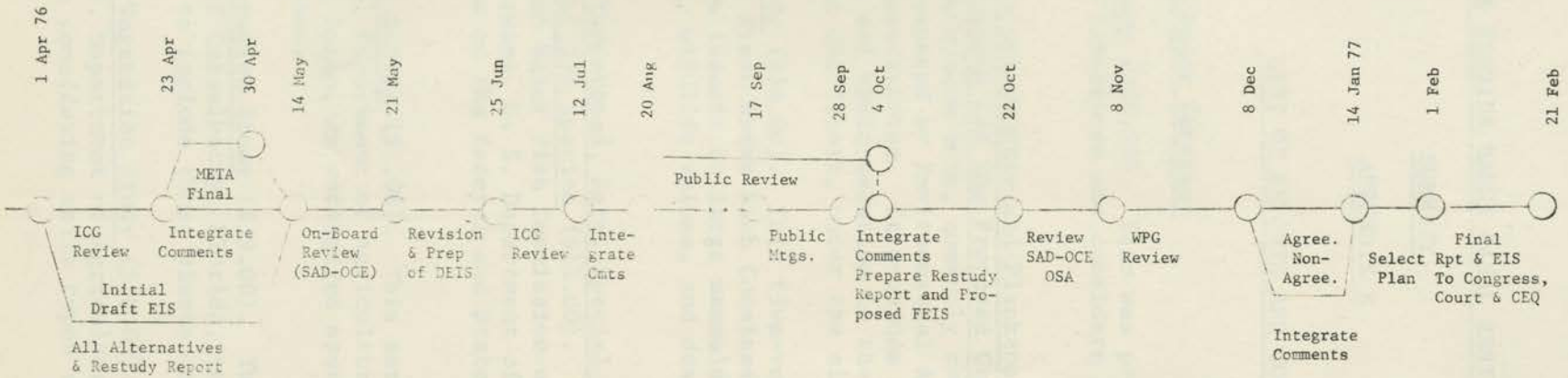
CROSS FLORIDA BARGE CANAL RESTUDY REPORT

SUMMARY

APPENDIX A

Revised Restudy Report and EIS Schedule
(See following page)

REVISED RESTUDY REPORT AND EIS SCHEDULE



August 1976

CROSS FLORIDA BARGE CANAL RESTUDY REPORT

SUMMARY

APPENDIX B

LIST OF REPORTS AND COSTS

A. Reports Prepared Under Contract

1. Fisheries Study ($35.00). This was prepared by the Florida Game and Fresh Water Fish Commission and considers fish populations and angler use and harvest.

2. Benthic Macroinvertebrate and Plankton Communities of the Associated Aquatic Systems for the Proposed Cross Florida Barge Canal ($27.00). This three-volume work, commonly referred to as the Plankton Benthos Study, was prepared by Environmental Research and Technology, Inc., of Concord, Massachusetts. It provides data and analysis on plankton and benthic organism and their relation to the aquatic environment as it exists now, or may in the future, under the alternatives considered.

3. Wildlife Study ($54.00). This five-volume report was prepared by the Florida Game and Fresh Water Fish Commission. It discusses a wide range of species from insects to large mammals and understory vegetation. It considers hunting, wildlife values, and describes faunal to habitat associations.

4. Endangered, Threatened, Rare, Special Concern, Status Undetermined and Biologically Sensitive Species ($11.00). This was prepared by the Florida Game and Fresh Water Fish Commission under funds provided by the Fish and Wildlife Service, U. S. Department of Interior. The report discusses the species on the Federal and State list, plus others considered significant.

5. Eagle-Osprey Survey ($1.00). This survey was prepared by the Forest Service, U. S. Department of Agriculture, concerning populations of the Southern Bald Eagle, an endangered specie, and the Osprey, which is listed as threatened.

6. Aquatic Vegetation Study ($39.00). This study by Joyce Environmental Consultants, Inc., of Casselberry, Florida, covers the aquatic vegetation of the project area to include those plants considered as nuisance.

7. Terrestrial Vegetation Study ($20.00). This study, prepared by the Forest Service, U. S. Department of Agriculture, covers the terrestrial overstory vegetation considering soils types and vegetative land use.

8. Water Quality Aspects with a Section on Waste-Assimilative Capacity ($21.00). The Geological Survey, U.S. Department of Interior, prepared this report. It was a one-year intensified effort at collection of water quality data, with a section considering the effect of possible future development in the project area. This report is also available through the U. S. Geological Survey.

9. Aquifer Tests in the Summit Reach of the Proposed Cross Florida Barge Canal near Ocala, Florida ($3.00). This investigation, conducted by the Geological Survey, U.S. Department of Interior, considers the impact of construction on the Floridan Aquifer in the Summit Reach area near Ocala. This report is also available from the U. S. Geological Survey.

10. Recreation and Related Aspects ($12.00). Prepared by the Bureau of Outdoor Recreation, U. S. Department of Interior, this study considers future recreation potential of the project area.

11. Meta Systems, Inc., of Cambridge, Massachusetts, has prepared the following reports:

a. Overall Assessment ($26.00). The overall assessment ties the work of the other environmental reports listed above into one assessment. It also provides a summary of the reports listed below:

b. Hydrologic Budget ($6.00). The purpose of this report was to ascertain the effect of the alternatives on the hydrologic regime of the area and to identify specific effects on water supply, discharge, and stages in the affected areas.

c. Nutrient Budget ($22.00). This report develops nitrogen and phosphorus budgets for the Oklawaha and Withlacoochee Rivers as they may be affected by the project.

d. Air Quality Analysis ($1.00). A survey of current air quality with projected impacts of the alternatives considered in the project area.

e. Socio-economic Evaluation ($16.00). This presents a study of demographic and economic trends for the project region and shows the probable effect of completion or non-completion of the project.

f. Benefit Alternatives Substudy. (FREE) This study deals with alternative means of deriving project benefits.

g. List of Concerns (FREE). This is a listing of issues on the project with the contractor's response thereto.

h. Phase I Socioeconomic Findings. (FREE) This is a brief writeup describing the results of the Phase I socioeconomic studies.

12. Highest and Best-Use Study. (FREE) This report by the University of Georgia discusses possible uses of the Oklawaha River Basin and Lake Rousseau considering economic and environmental values. It was funded by the EPA.

13. An Evaluation of the Transportation Economics of the Cross Florida Barge Canal, by A. T. Kearney, Inc. The separate report volumes are available as follows:

a. Executive Summary, Volume I ($7.00). This is a summary of their findings.

b. Project Report, Volume II ($20.00). This volume contains more detailed information than that of Volume I, Summary Report.

c. Analysis of Traffic Flow Data, Appendix A ($31.00). This volume is mainly a computer printout of traffic flow data.

d. Rate Analysis Methodology, Appendix B ($5.00). The purpose of this appendix is to describe the methodology for construction of waterway rates for movements through the Cross Florida Barge Canal.

B. Reports Prepared by the Corps of Engineers

1. Summary (FREE). A summary of the information contained in the following reports is presented in this volume.

2. Engineering ($9.00) . This volume presents the engineering considerations including discussion of designs, hydrology, geology, and presents estimated costs.

3. Engineering, Appendix A (Geologic). ($26.00). This is an appendix to the Engineering Report which contains the plates and tables showing the geologic data. This report also has a reprint of the discussion of geologic data from the Engineering Report.

4. Economics ($3.00). This report compares costs and benefits for the project.

5. Environmental ($5.00). This report summarizes the environmental contractor's reports.

6. Draft Environmental Impact Statement (FREE). The Draft EIS summarizes the environmental impacts of the alternatives studied.

7. Scenarios ($3.00). This provides the basic information on the alternatives to this project. This document is frequently referenced in most of the reports.

C. To obtain any of the above reports, send your request to the U. S. Army Corps of Engineers, Jacksonville District, ATTN: CFBC Special Project Office, P. O. Box 4970, Jacksonville, Florida 32201. Make your check payable to the TREASURER OF THE UNITED STATES.

CROSS FLORIDA BARGE CANAL RESTUDY REPORT

SUMMARY

APPENDIX C

LIBRARIES HOUSING CFBC REPORTS

A. The below listed libraries have been provided sets of reports to make them available to the public.

1. State Library of Florida
   Supreme Court Building
   Tallahassee, Florida

2. Florida State Department of Administration
   Division of State Planning Library
   660 Apalachee Parkway
   Tallahassee, Florida

3. Dunnellon Public Library
   309 West Pennsylvania Library
   Dunnellon, Florida

4. Haydon Burns Library
   122 North Ocean Street
   Jacksonville, Florida

5. Miami-Dade Public Library
   One Biscayne Boulevard
   Miami, Florida

6. Ocala Public Library
   15 South Osceola Avenue
   Ocala, Florida

7. Orlando Public Library
   10 North Rosalind
   Orlando, Florida

8. Palatka Public Library
   216 Reid Street
   Palatka, Florida

9. Santa Fe Regional Library
   222 East University
   Gainesville, Florida

10. Tampa Public Library
    900 North Ashley Street
    Tampa, Florida

11. Robert Manning Strozier Library
    Florida State University
    Tallahassee, Florida

12. University of Florida Libraries
    University of Florida
    Gainesville, Florida

CROSS FLORIDA BARGE CANAL RESTUDY REPORT

APPENDIX D

MAJOR ISSUES

One of the purposes of the restudy report has been to address the major issues that have surfaced during the history of the project. These issues were used in selecting the various alternative plans for study and in planning the environmental, economics, and engineering investigations. Several of the more critical issues that could affect any decision concerning the project are discussed in the following paragraphs.

A. GEOLOGY

1. Given the tendancy of the local geology to solution holes, what problems with porosity and leakage could occur? What are the implications for changes in the hydrology on water quality in the aquifer?

Collapses of limestone, cavern fills, or overburden in vicinity of Cross Florida Barge Canal could occur in response to construction vibration and loads, changes in water levels in the aquifer, canal and embankment loading, and seepage. Solution or erosion of limestone or cavern filling could occur as a result of water level rise or fall and canal seepage. The problems are understood and have been taken into account in the engineering design and costs. Porosities are not uniform and must be anticipated and dealt with as they occur.

As the USGS has stated, changes in the water quality of the Floridan aquifer are not likely to be significant from changes in water level or from diversions of tributaries. The surface water is normally dominated by ground water discharges -- not surface drainage. Nutrient removal by plants and oxidation of organic materials in the surface water would reduce concentrations of these materials in the ground water if aerobic canal water were to infiltrate.

2. What is the status of Oklawaha River "fracture zones" in the canal route and could the dams cause or be damaged by earthquakes?

The Oklawaha floodplain is underlain by many layers of low permeability riverine deposits which have supported the river since its origin. The proposed dams are highly unlikely to cause seismic effects other than microseismic. While such natural earthquakes in this area are possible, the possibility of occurrence and damage is remote and is not a significant issue in the evaluation of the environmental consequences of the project.

3. What is the extent and quality of geological (mineral) resources in the canal area?

There are large deposits of aggregate, dolomite, limerock and small hard rock phosphate deposits in the area. Aggregate, dolomite, limerock, fullers earth, ilmenite, and other rare ores are mined in the region. Aggregate, dolomite, and limerock are mined principally for local use.

B. HYDROLOGY

1. Are water supplies in drought periods sufficient to operate the canal? Would extensive additional pumping facilities be required?

The water supply available during years of severe drought is not sufficient for continuous use of the barge canal at the maximum design rate of 36 lockages daily (27 locksful of water) and for maintenance of satisfactory flow rates in the lower reaches of the Oklawaha and Withlacoochee Rivers. In addressing the significance of the flow shortage, it should be noted that the so-called "design rate" is based on the maximum rate at which the locks can be filled and emptied rather than on the peak rate of barge traffic expected. Drought flows corresponding to those of the drought of 1956-1957 have an estimated average return period of about 25 years. The analysis of regulation indicates that water is available in the reservoirs under all alternatives to allow canal operations at reduced rates even during droughts as severe as that of 1956 and 1957.

In the authorized alternative if a total of 750 c.f.s. is allocated to the streams below the dams (400 c.f.s. to the Oklawaha River and 350 c.f.s. to the Withlacoochee River), then the remaining inflow coupled with flow from pool drawdown would support a traffic level of at least 22 passages per day or about 62 percent of the maximum design rate of 36 passages. The results are based on the alternative design plan with three pumping stations (at Eureka, Bert Dosh, and Dunnellon Locks).

2. How much exchange of water will possibly occur between the Summit Pool and ground water of the aquifer? What are the implications for pollution of the aquifer?

The USGS estimated that the flow pattern of 8 percent of Silver Springs' supply will be altered with the construction of the Summit Reach. It is considered that the pollution implications of the two Summit Reach alternatives are minor.

3. What is the extent of danger that pollution of the Summit Pool will occur from nearby residential and industrial development, leakage or spills from barges and turbidity caused by the construction or dredging?

Future residential and industrial development in the area of the canal would not significantly affect water quality in the Summit Reach as Public Law 92-500 is implemented and enforced. Spills or leakage from barges present an important management problem. There are techniques to contain and clean up insoluble liquid materials.

Turbidity can be caused by maintenance dredging, construction and by passage of vessels where the bottom deposits of the canal or shallower edges of rivers, lakes, or impoundments can be resuspended. Construction and maintenance activity generates turbidity which can be locally disruptive to ecological systems both at the dredging site and where the materials are redeposited. These impacts would be local and temporary.

4. What is the possibility and danger of accidental spills of oil or toxic materials from barges?

Given proper design and construction of vessels and terminal facilities and good operation and maintenance, the frequency of spills can be greatly reduced, but accidental spills can never be completely eliminated. Spill cleanup equipment would be kept at control points along the canal. U. S. Coast Guard control of potentially hazardous or unsafe vessels is discussed in the Environmental Impact Statement. Aside from the impacts on aquatic organisms the major danger from spills of toxic substances is ground water pollution. The USGS report states that the only reach of the canal where this would be a significant problem is the Summit Reach. In order to protect the aquifer from spills which cannot be contained, it may be necessary to rapidly draw down the Summit Reach. Hydraulic controls are available to do this. This would, of course, impair habitats in the downstream reaches.

5. Could the different chemical character of the Oklawaha River water back-pumped to the Summit Pool accelerate solution of limestone there?

Yes. The possible effects were studied by the USGS but have not been quantified nor the extent projected for the life of the project. When the ground water level is higher than the canal levels, there would be no increase in solution rates. However, in reaches where the canal level is higher and flow is from the canal to the aquifer, there would be some undetermined rate of solution. The rate of solution would depend upon the volume of water and its chemical characteristics. This is not considered to be a significant problem.

6. Is the Withlacoochee River water compatible with ground water in the Summit Reach should it have to be pumped up?

The waters are compatible, and as the groundwater levels are generally above canal levels near the western part of the Summit Reach, solution and infiltration problems are not likely.

7. What is the likelihood and extent of leakage from the Summit Pool to lower pools?

Water leaving the outflow zones would proceed through the aquifer to either Silver Springs or the Withlacoochee River and thence to a lower pool. Some leakage could occur near the locks. In the vicinity of Bert Dosh Lock a stratum of clay lies between the canal bottom and the aquifer. Seepage to the lower pool, therefore, would be small. There is a bed of limestone at the Dunnellon Lock site that would allow some seepage to the lower pool. The quantity is estimated at about 10 c.f.s. Leakage through the locks would be minimal. There is also a possibility that areas with isolated fractures, solution channels, and/or faults large enough to cause a concentration of outflow would be found during construction. The cost estimates include costs of grouting such areas.

8. What is the canal's overall impact on water quality? Is water quality in the canal expected to meet or exceed minimum State regulation standards? Are oxygen sags in the other reservoirs comparable to project reservoir conditions?

During construction turbidity conditions in the immediate areas of dredging will at times not meet State standards for Class IV and higher waters. Dissolved oxygen concentrations may also be reduced below those required by State standards in immediate areas of dredging. During maintenance dredging similar conditions will occur for short periods in the immediate area of the dredging. For the first year after construction suspended solids after heavy rainfalls and high flows may cause turbidity levels to violate State standards. Decaying vegetation will lower oxygen levels in deep parts of the reservoirs below 5 milligrams per liter during summer months. Lake Ocklawaha presently becomes thermally stratified at the lower end during the summer.

Eureka Pool probably will also become thermally stratified, in which case oxygen concentrations predictably range from a condition of supersaturation to one of oxygen depletion during 24-hour periods. Such will be the long-term conditions in the deep, stratifying parts of reservoirs. In the narrow canal segments vessel traffic may agitate the water enough to aerate it and keep oxygen concentrations at acceptable levels. In the Summit Reach turbulence will not result in turbidity because the bottom there is mostly limestone and fairly clean sand.

Grab samples during 1968-1974 show that minimum DO at Lake Ocklawaha and Lake Rousseau are lower than 4 mg/1. Samples taken in 1975 at these water bodies further show temperature and DO stratification with DO near zero ppm at the bottom during summer and fall. In the near future, DO condition will not be significantly different if dense weeds are present continuously. Harvesting aquatic weeds to prevent formation of dense aquatic beds will improve the condition.

9. How will construction affect turbidity in Silver Springs? Can negative effects be controlled?

It would not noticeably affect turbidity unless a direct cavernous connection were intersected. Such an event would be obvious and could be immediately corrected by pumping to lower water elevations in the vicinity of the construction and sealing.

10. What effect would further canal excavation have on the existing impoundments?

Dredged material will be placed alongside the canal to form islands. Temporary increases in turbidity, nutrients, and biochemical oxygen demand (BOD) are expected as stated in Water Quality Report. The resuspension of bottom materials in Lake Ocklawaha would temporarily increase the biochemical oxygen demand (BOD) and the concentrations of nitrogen and phosphorus. Because bottom materials at the lower end of the lake contain much higher concentrations of nitrogen, phosphorus, and organic material than at the upper end of the lake, resuspension would have a greater effect on nutrient concentrations and BOD at the lower end. Since nutrient supplies are not now limiting aquatic plant growth in Lake Ocklawaha, increased dissolved nutrient concentrations would not stimulate plant growth, and accompanying turbidity levels would tend to inhibit photosynthetic rates. The BOD exerted by the resuspended organic sediments would tend to decrease the already low dissolved oxygen concentrations that occur during summer. As with turbidity, these effects would be limited to the immediate environs of dredging. Benthos in dredged and disposal areas would be killed. Additional littoral habitat would be created around the disposal islands, and little impact on the reservoir's productivity would result.

Turbidity and suspended sediment during canal dredging will probably be a greater problem in Lake Rousseau than in Lake Ocklawaha because Lake Rousseau is a much older reservoir. The layer of fine sediment and organic materials on the bottom probably is thicker than in Lake Ocklawaha. Consequently, since average flow velocities will be higher in Lake Rousseau than in Lake Ocklawaha, the sediments disturbed by dredging in Lake Rousseau would tend to remain in suspension longer. Rooted aquatic plants which are abundant in Lake Rousseau would retard the movement of suspended sediment and reduce the turbidity. However,

in view of the higher velocities, smaller surface area, and the lower density of aquatic plants in Lake Rousseau, plants will probably be less effective in reducing turbidity in Lake Rousseau than in Lake Ocklawaha. The effect of dredging on the growth rate of plants is not expected to be different in Lake Rousseau than in Lake Ocklawaha. The increase in phosphorus concentrations as a result of dredging is expected to be much larger in Lake Rousseau than in Lake Ocklawaha, but it is unlikely that phosphorus is a limiting factor in the growth of these plants. As in Lake Ocklawaha, the resuspension of organic material in Lake Rousseau would probably increase the oxygen demand and remove dissolved oxygen from the water in the immediate area of dredging. Plant photosynthesis would replace much of the oxygen removed so that the effects of dredging on dissolved oxygen concentrations may be limited to the area near construction.

11. What effect will aquatic plants have on the recreational and economic uses of the canal and its impoundments?

Maintenance operations for aquatic plants will be required to provide open water for recreation use in areas which are not kept open by commercial traffic. The aquatic plant contractor states that commercial traffic would provide a self-maintaining channel through physical destruction or displacement of plants, however, chemical or physical control measures would be required in order to assure that channel and reservoirs are available for multiple use. The current cost estimates for each of the alternatives under study includes aquatic vegetation maintenance costs necessary to maintain the barge channel and small boat navigation trails for fishing access, and other recreational activities.

Future management plans would include combinations of recreation, fish, wildlife, and forest-associated objectives. Such a program, perhaps encompassing different primary objectives in various canal area segments, probably would include aquatic and terrestrial weed control, mosquito control, forest management, wildlife habitat manipulation, recreation area maintenance, road maintenance, structure maintenance, and law enforcement. Techniques may be selected from an array of proved and experimental ones, including mowing; herbicide, insecticide, and fertilizer applications; use of biological control agents; ditching; grading; timber and brush cutting; controlled burning; reservoir-level manipulation; snagging; maintenance dredging; and controlled hunting. The details of the management programs will be based on the results of the current studies and consultation and coordination with other agencies having the required expertise. The management plan would be administered by the Corps of Engineers.

12. What is the potential of salt water being locked into Lake Rousseau?

Operation of Inglis Lock occasionally introduces salt water into the canal just above the lock, but the salt water is diluted and flushed into the Lower Withlacoochee River through the bypass channel. The specific conductance of water in Lake Rousseau has not increased as a result of operating the lock. Sustained commercial operations and frequent lockages would introduce more fresh water into the area below Inglis Lock, reducing the lockage of salt water into Lake Rousseau.

C. ECOLOGY

1. To what extent will the canal destroy the existing ecosystem of the Oklawaha region? How would the new ecosystem compare in terms of species diversity, and ecological "value" to the existing system?

The Cross Florida Barge Canal alternatives range in their effect on the existing ecosystem from almost complete replacement of a large terrestrial ecosystem with a reservoir (authorized alternative) to retention of a portion of the river, most of the terrestrial system, and a reservoir (Upland Eureka to Bert Dosh Lock Alternatives). The existing river flood plain will be replaced by a lake environment. There is no unit of measurement to evaluate the two ecosystems. The reservoir system represents less diversity and is, in general, less desirable ecologically in Florida (because it is more common and technologically available) than the system it replaces.

2. What will be the long-term effects of the "nutrient trap" problem experienced in Lake Ocklawaha on fishing, recreation, and water quality?

Nutrient budget studies by Meta Systems, Inc., indicate the long-term effects of the "nutrient trap" problem are not likely to be substantially different than problems experienced today. Management may be required.

3. Could the canal provide a route for "undesirable fishes" to get from coast to coast?

Three exotic fishes are identified in the Fisheries Report as present in the St. Johns River: blue tilapia (Tilapia aurea), goldfish (Carassius auratus), and an unidentified species of armored catfish (Hypostomus, sp.). Of these, only the blue tilapia is considered noxious because it is of low catchability and competes with native fishes for spawning area. It appears to be especially adaptable to water bodies subject to low dissolved oxygen concentrations. The fish presently is already the most rapidly spreading exotic in central Florida, being distributed from Pasco and Charlotte Counties on the gulf coast, eastward to Orange Lake and Putnam Counties. Its range extension in Florida was not, therefore, identified as a potential effect of the Cross Florida Barge Canal.

4. In the Overall Assessment, is Lake Ocklawaha better fishing than the Oklawaha River?

The quality of river fishing is valued more highly than reservoir fishing in the Overall Assessment. However, reservoirs with recreation facilities attract more users.

5. What could be the effects of using 2-4,D and other chemicals for weed control in the impoundments?

EPA has recently approved the use of 2,4-D in flowing waters and in potable water supply areas. Extensive testing of 2,4-D has shown it to be biodegradable and that it does not harm fish and wildlife in the concentrations used for hyacinth control. Chemical control of water hyacinths results in the killing of the plants. The dead tissue usually is allowed to sink and decay. If extensive mats of these plants are allowed to accumulate before the initiation of control efforts, the resulting decay of large quantities of the plants can decrease water quality conditions through reduced dissolved oxygen levels and the recycling of large quantities of plant nutrients. Current control efforts are programmed to prevent the build up of extensive infestations through selective spraying and routine patrolling. This approach not only reduces the amount of chemical necessary for control, but also eliminates the deleterius effects upon water quality conditions.

6. Could some of the trees partially inundated in the reservoir (Lake Ocklawaha) be saved by drawdown?

Trees presently flooded and living in Lake Ocklawaha could perhaps be saved by permanent drainage of the reservoir. If Lake Ocklawaha remains the long-term outlook is that all standing trees will eventually fall. Reservoirs tend to raise ground water levels nearby, and this may cause a change from one type of vegetation to a wetter one of the same type, or succession to a wetter type.

7. Need for a nutrient budget?

The investigations of the nutrient budget by Meta Systems, Inc., did not result in any unexpected findings. The phosphorus concentrations in both Rodman and Inglis were found to be closely in line with a formulation derived for prediction of phosphorus concentrations based on statistical analysis of several other lakes in Florida. This formula predicts concentrations from loading, lake mean depth, and detention period. Like many other lakes in the region, flux rates of nutrients are high. The outputs from both the Rodman and Inglis pools would be sufficient to fertilize much larger bodies of water.

Natural nutrient fluxes are high -- much larger than fluxes likely to be generated by development -- and aquatic biological processes are not limited by nutrient supply.

8. Need for a water budget?

The results of the hydrologic budget by Meta Systems, Inc., yield conclusions essentially similar to those of the 1963 report of the Jacksonville Office. After incorporating water demands and consumptive losses associated with development over the projection period and making conservative estimates of evaporation from the pools, and a conservative assumption as to the timing of irrigation withdrawals during dry periods, it was found that the remaining available flow at both ends of the barge canal was insufficient to allow 36 lockages daily and to provide desired conservation flow in the lower reaches of the Oklawaha and Withlacoochee Rivers. It is estimated that the economic and demographic levels projected for 2035 A.D. water deficiency begins to be important at about the frequency of the one-in-ten year weather flow. It is noteworthy that in the studies of the 1955-1957 drought, simulated with the development levels of 2035, the water shortages were almost as critical in the without project alternatives as in the with project alternatives. That is, the depletions due to development -- especially those for irrigation -- are more signifcant than losses deriving from the canal. During years of normal flow and in wet years, the pattern of runoff in 2035 will be similar to that of the present time and the desired conservation flows can be maintained.

9. Will new legislation on endangered species be taken into consideration during the studies?

Species which occur in the canal area have been compared to official lists of endangered or otherwise stressed species and are so designated in the Wildlife Study report and EIS. Federal and State designated species are listed with expected impacts of alternative actions.

D. LAND USE

1. The canal is being evaluated in the absence of any overall land use plan.

There is no overall land use plan for the region (or the State). The State is in the process of developing State land use plans. To date there is no State-wide process for reviewing the compatibility of a project such as the canal with State or regional land use objectives. Four counties have comprehensive or master plans -- Putnam, Marion, Citrus, and Levy Counties. Those counties in their

comprehensive plans have included the Cross Florida Barge Canal. The land use analysis carried out as part of the Meta Systems, Inc., socioeconomic evaluation revealed no major land use conflicts related to the canal other than those taken into account in the Overall Assessment.

2. How can property owners adjacent to the canal obtain access to it?

The Corps would control a minimum 300-foot-wide collar around the project reservoirs and channels. Public access would be provided through recreational access points on public lands. A private property owner adjacent to the collar could gain access to the project waters through construction of access channels or ramps. Permits would be required for any such construction both from the State and Corps of Engineers. In accordance with current laws and policies, approval would be based on careful evaluation of the environmental impacts of any such proposal.

E. CANAL CONSTRUCTION AND OPERATION

1. What are the current limits on the traffic the canal can handle according to its lock sizes, depth, and width? How can the CFBC tie in with the existing canal systems and trans-Gulf barge traffic?

The waterway characteristics of the CFBC are:

Channel depth	dependable 12 feet
Channel width	150 feet
Tow width	55 feet
Lock size	84 feet x 600 feet
Lock capacity	36 lockages/24 hours
Bends	Capable of passing design tows

The project is designed to handle the standard draft river-Gulf barges (typically 195 x 35 feet) which are certified to cross the Gulf of Mexico by the U. S. Coast Guard. The CFBC was not designed to handle deep-draft ocean barges. A. T. Kearney also studied the CFBC tie with existing canal systems and developed the transportation savings that would accrue if the GIWW were extended from Carabelle to the CFBC. Results are contained in the Kearney Executive Summary, Volume I, and in the Project Report, Volume II.

2. How and where will disposal material be placed from excavation through the reservoirs?

The disposal sites diagrammed in the Scenarios and in the Engineering Report encompass sufficient area to accommodate all material to be dredged. Should it appear that fish and wildlife interests may be served by creation of disposal islands in Lake Ocklawaha,

Eureka Pool, and/or Lake Rousseau, this could be done. Siting and design of the islands would be accomplished later and coordinated with appropriate agencies. In addition, the Wildlife Study Report contained recommendations for relocation of disposal sites MDA-1, CDA-2 (St. Johns Reach), DA-6 (Lake Ocklawaha Reach), D/A-8-B (Eureka Reach), and D/A-13 (Lake Rousseau Reach). Relocation of these sites will be considered in coordination with appropriate agencies.

3. Could further construction accelerate eutrophication of Rodman and Eureka impoundments?

Dredging channels in Lake Ocklawaha and in Eureka Pool and maintenance dredging there will not add nutrients to the already nutrient-rich impoundments, nor will dredging appreciably increase plant growth rates. Therefore, channel excavation and dredging will not accelerate eutrophication in the sense of increasing the rate of nutrient supply nor in the sense of increasing the rate of build-up of detritus.

F. ECONOMICS

1. Is the discount rate used to calculate the benefit-cost ratio "reasonable"?

Average annual charges and benefits have been computed for three interest rates. The interest rate of 2-7/8% was the rate in effect for Fiscal Year 1964, the year in which construction appropriations were first provided for the CFBC project. Pursuant to Section 80(b) of the Water Resources Development Act of 1974, 2-7/8% is the legal interest rate to be used in evaluating the feasibility of constructing the CFBC project, as authorized. The interest rate of 6-1/8% is the rate in effect for Fiscal Year 1976 for plan formulation, evaluation, cost allocations, and reimbursement studies for new project proposals. Computations based on this interest rate are shown to provide data for the Cross Florida Barge Canal project comparable to that for new project decisions. The interest rate of 6-7/8% was the interest rate proposed in September 1973 by the Water Resources Council for application under the Principle and Standards for planning water and related land resource projects. That rate was rejected by Section 80 of the Water Resources Development Act of 1974. However, the plan of study for the restudy indicates that 6-7/8% will be used as the upper range of interest rates to demonstrate the sensitivity of project analysis to various interest rates.

2. How were the amount of traffic and freight savings per ton mile calculated?

Detailed explanation of the procedure used by A. T. Kearney to forecast canal traffic is contained in their Executive Summary, Volume II, and appendix B. Briefly, the method involved the following steps:

a. Identify traffic flows by commodity group between economic centers (BEA Economic Regions) which might use the CFBC.

b. Use traffic flow analysis to identify specific shippers and receivers to be interviewed.

c. On the basis of the interviews, designate potential traffic for the CFBC.

d. Employ OBERS-E projections to forecast traffic tonnage to 2035.

Savings to shippers were calculated by:

a. Constructing waterway rates for movements through the CFBC which approximated the current market; and

b. Performing a comparative rate analysis for the existing transportation mode for all traffic identified and forecast.

3. What effect is the canal likely to have on land values in the corridor?

The canal is likely to increase land values in the corridor. Such values are merely a capitalization of the lower charges on water transport and the value in use of the recreation resources provided are measured in the direct benefits. No land enhancement per se is included in the benefit evaluation for the report.

4. How were the recreation benefits calcuated for the canal? How do the recreational values applied compare to use of the area in its present state?

Recreation benefits are calculated by forecasting recreation days, with and without the project. Additional facilities would have to be provided to realize those benefits. A dollar value was then applied to each recreation day to compute the recreation benefits. Recreation day values are developed in the BOR report and summarized in the Corps Economics Report.

5. Is the traffic calculated for the CFBC dependent on completion of the GIWW or would CFBC stimulate its completion?

In developing the benefit analysis for the CFBC, Kearney assumes that the "missing link" of the GIWW will not be built. Kearney based the benefit computation on river-gulf type barges moving across the open gulf. In a separate evaluation they evaluated the economic impact that completion of the GIWW would have on the CFBC benefit base.

6. Will related costs - such as bridges - borne by local or State governments be included in the benefit-cost ratio?

Those costs are included in the benefit-cost calculation.

7. Can energy costs comparisons be included in the benefit-cost ratio?

Since a market exists for energy and units of energy have prices, the costs of energy are included in the benefit-cost ratio. Kearney analyzed each move in the benefit base for potential energy savings for a CFBC routing. The net results were inconclusive.

8. Have secondary impacts been adequately considered?

Extensive field interviewing data, review and analyses were carried out under the Corps contract and a supplemental contract provided by EPA. The socioeconomic evaluation by Meta Systems, Inc., found that development induced by the canal was likely to be relatively small in this rapidly growing four-county region. For example, population increase is not expected to be greater than 10 percent.

The population density, considering the project completed, increases slightly in this 4,000-square-mile area but is well below the average density in Florida. There will be some expansion of the urban areas and a considerable amount of more diffuse development. The demand for and costs of services generally will increase only slightly and in some cases per capita costs of services can be expected to decrease. Land use patterns would be essentially unaffected except perhaps in the immediate vicinity of the canal, and the settlement patterns including large residential developments near towns, particularly Ocala, would only be impacted in that they might develop a little faster in the with-canal case than in the without-canal case. These differences in population and economic activity are not great enough to significantly affect the water and air quality in the region.

9. Has the Corps of Engineers formally arranged to "hold and save" from all damages or claims arising from construction of the project?

By resolution dated 6 October 1959, the Ship Canal Authority of the State of Florida pledged itself (among other things) to "hold and save the United States free from all damages due to the construction works."

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COMPLETE PROJECT

AUTHORIZED ALINEMENT

JACKSONVILLE
PALATKA
BUCKMAN LOCK
RODMAN DAM
EUREKA LOCK & DAM
SR 316
SR 19
DOSH LOCK
OCALA
SR 40
SILVER SPRINGS
INGLIS LOCK
DUNNELLON LOCK
YANKEETOWN
INGLIS
DUNNELLON
MOSS BLUFF
OKLAWAHA RIVER
INGLIS DAM
GULF OF MEXICO
WITHLACOOCHEE RIVER
I-75
SR 200
US 19

FIGURE 1A

PRESERVE....

COMPLETED WORKS

FIGURE 1B

RESTORE

JACKSONVILLE

PALATKA

SR 316

SR 19

SR 40

OCALA

SILVER SPRINGS

YANKEETOWN

INGLIS

DUNNELLON

I-75

WITHLACOOCHEE RIVER

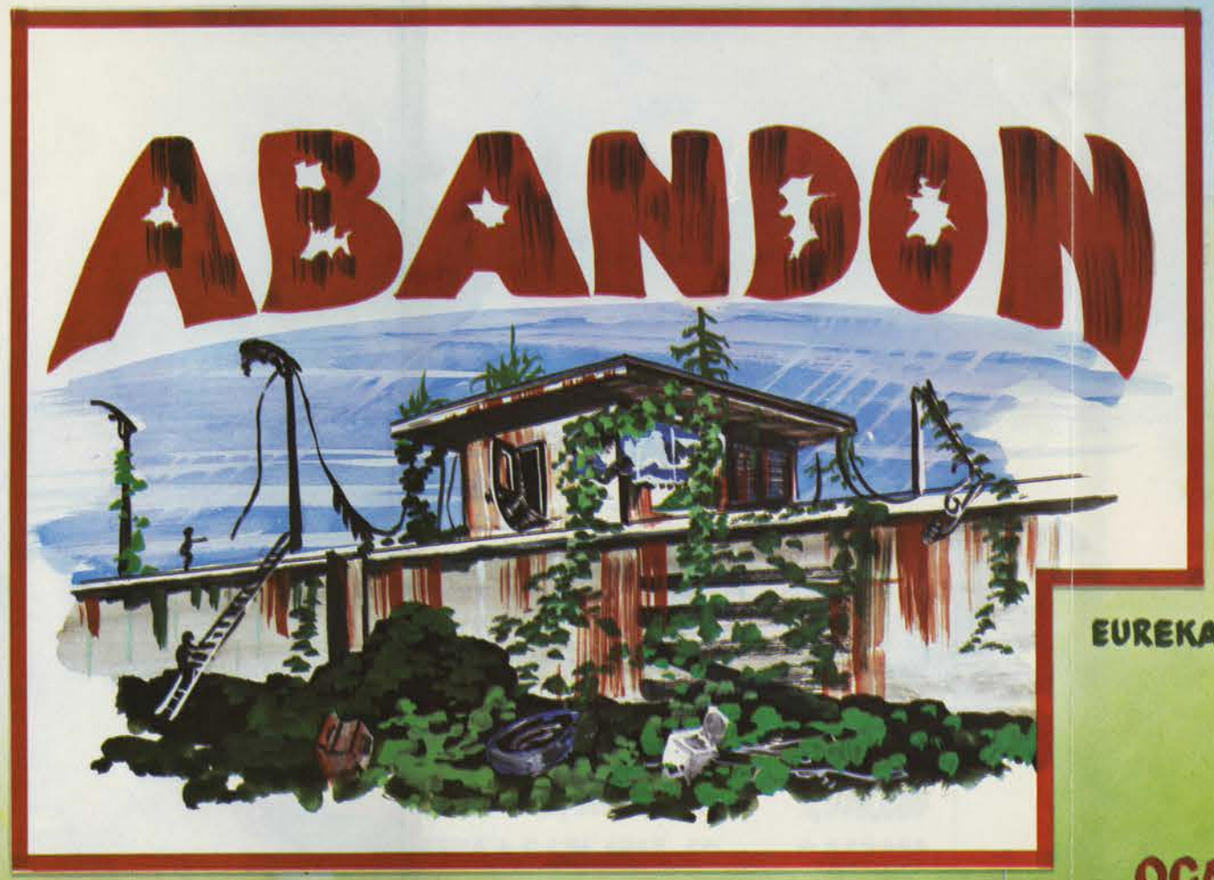
OKLAWAHA RIVER

US 19

SR 200

GULF OF MEXICO

FIGURE 1C



JACKSONVILLE

PALATKA

BUCKMAN LOCK

RODMAN DAM

EUREKA LOCK & DAM

SR 316

SR 19

OCALA

SR 40

SILVER SPRINGS

YANKEETOWN

INGLIS LOCK

INGLIS

DUNNELLON

MOSS BLUFF

INGLIS DAM

I-75

WITHLACOOCHEE RIVER

OKLAWAHA RIVER

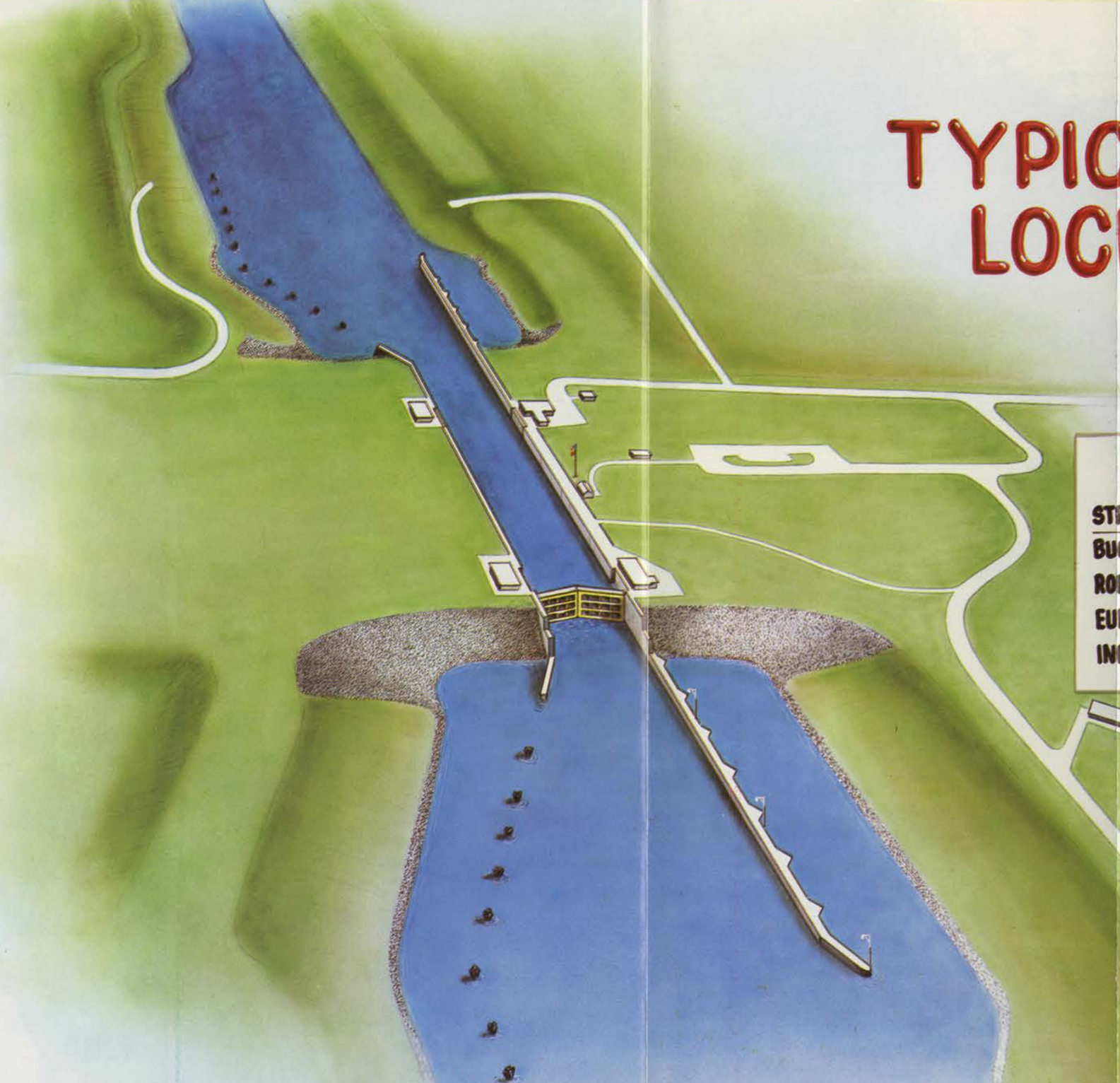
GULF OF MEXICO

US 19

SR 200

FIGURE 1D

TYPICAL LOCK



Completed Works

STRUCTURE	CONSTRUCTED	COST TOTAL
BUCKMAN L.	1964-67	$ 6,913,000
RODMAN DAM-SW.	1966-68	3,679,000
EUREKA L,D,SW.	1966-69	9,447,000
INGLIS L.	1965-68	7,225,000

FIGURE 3

COMPLETE PROJECT

EUREKA to HIGHWAY 40
UPLAND ROUTE

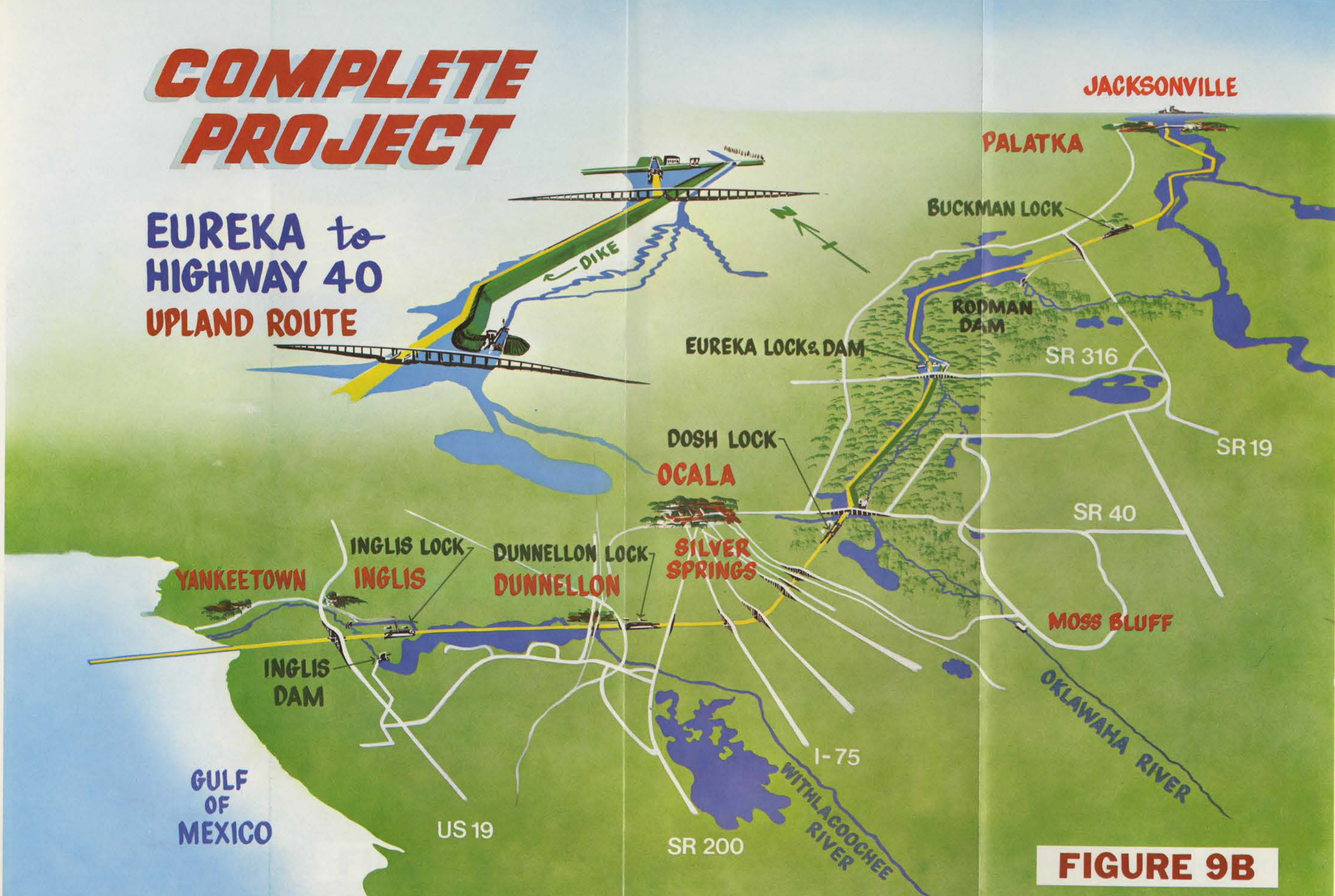


FIGURE 9B

COMPLETE PROJECT

EUREKA to BERT DOSH LOCK

UPLAND ROUTE

FIGURE 10B

TRANSLOADING FACILITIES

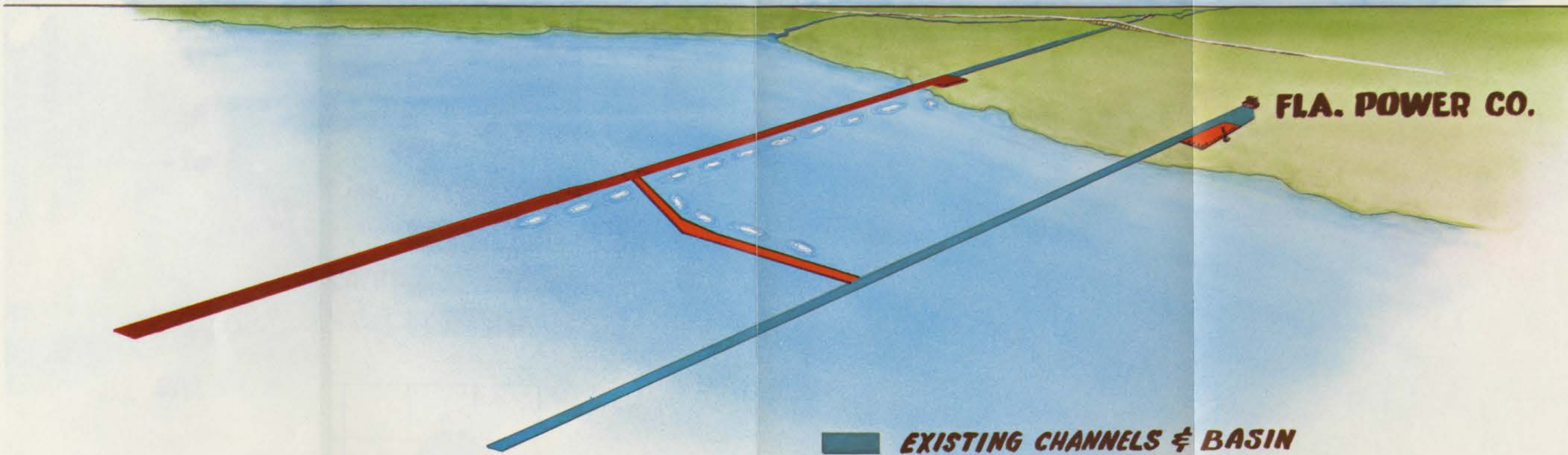
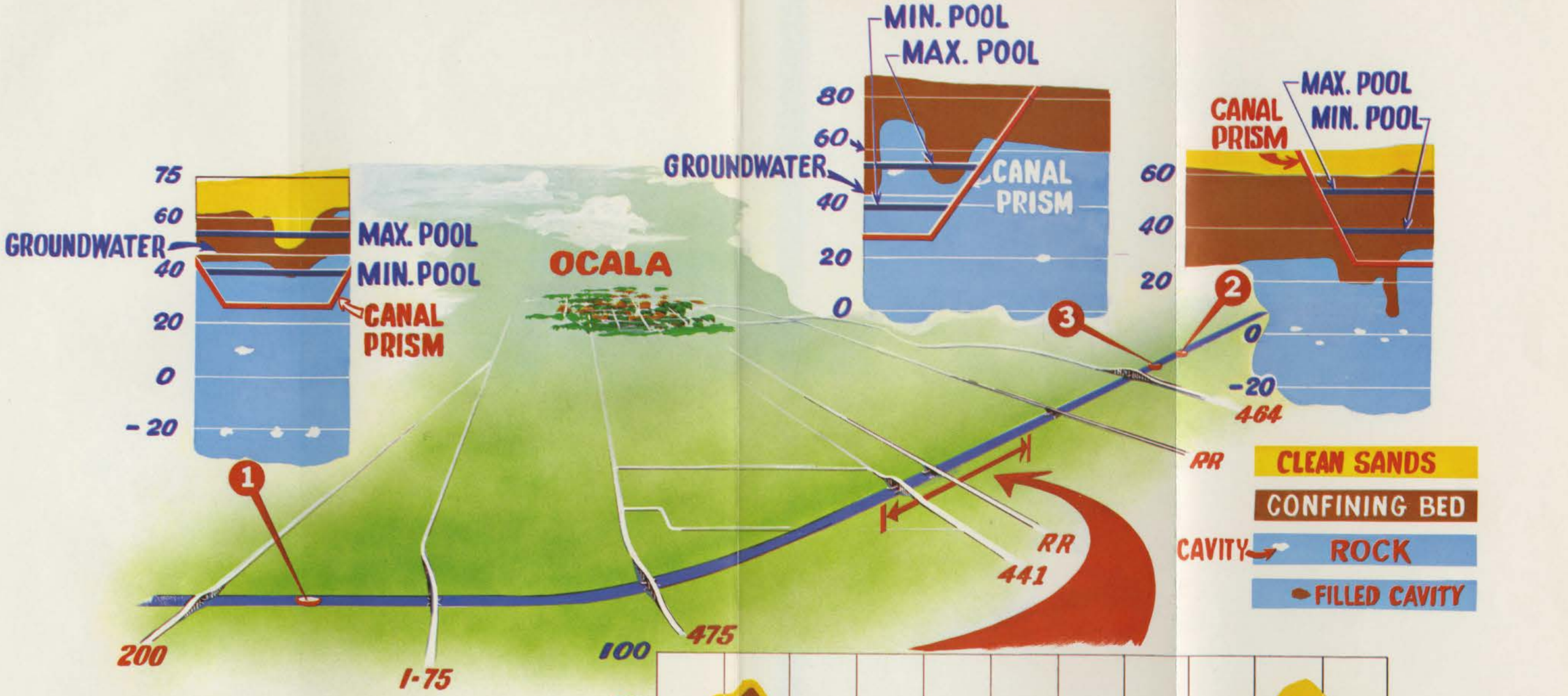


FIGURE 46C

PUMP TEST LOCATIONS



TYPICAL PROFILE

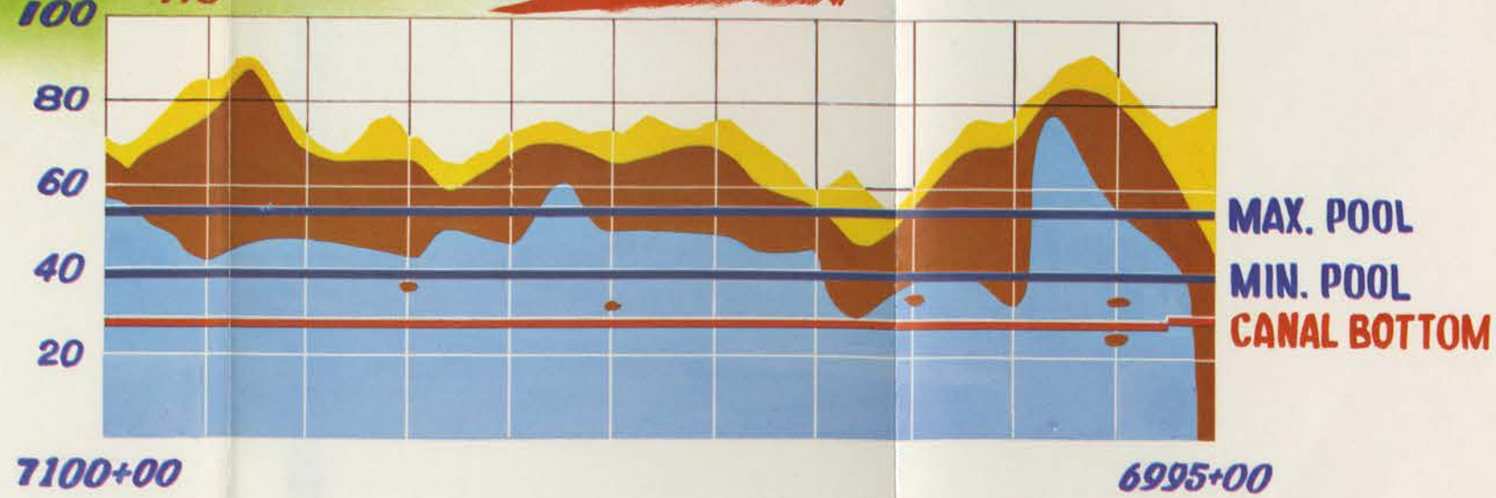


FIGURE 130A